ARMY RESEARCH AND DEVELOPMENT

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CRD, DCSLOG Emphasize Broad Value Analysis Program

Theme of the Month

Major General William J. Ely,
Director of Army Research, OCRD

It is of prime importance that Army research and development establish accurate guideposts into the future for the orienting and directing of its program. "Reduce lead time" is the R&D mandate, because of the political urgency of our times and because science and technology, with associated changes, are increasingly the basis of military power and national survival. This means proceeding under forced draft with the R&D program, telescoping a time-consuming and complex process.

Such action can lead to all sorts of lost motion in conflicting and wasteful efforts—marginal projects carried far beyond the proper point of abandonment; duplicate projects; projects yielding only obsolescent or obsolete end products; projects not started until the end product need is glaringly evident—unless Army R&D managers, scientists and administrators perfect procedures for a better analysis of what the Army of the future needs, and how and where Army R&D should act now to satisfy these needs.

Stated in over-simplified terms, R&D personnel must get out ahead of themselves, some 10 to 20 years in time, and survey the military scene from scientific, technological, and operational viewpoints. They must integrate these views and pass them back to the present, evaluating their impact on intermediate and current plans and efforts. In this fashion, they must establish a series of guiding landmarks into the future.

The most challenging, difficult, and important part of such a scheme is the establishment of the distant evolving objective. The projection of what science and technology might offer one to two decades into the

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Techniques of Value Analysis are scheduled to come into sharp focus in all Army research and development activities during coming months by direction of Lt Gen Arthur G. Trudeau as part of a concerted cost-cutting campaign.

Determined that Army R&D management officials shall take a long hard look at every possibility of offsetting rising production costs of weapon systems and material, General Trudeau is working closely with the Deputy Chief of Staff for Logistics to advance the Value Analysis concept.

The kickoff action is a jointly sponsored seminar to which about 300 Army and industry representatives have been invited. It will be held in the Pentagon, Room 5A-1070, Washington D.C., on Oct. 20.

Assistant Secretary of the Army (R&D) Dr. Finn J. Larsen, Deputy Chief of Staff for Logistics Lt Gen Robert W. Colglazier, Jr., Comptroller of the Army Lt Gen David W. Traub, Chiefs of the Technical Services and

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DOFL Scientist Gets $5,000 Secretary of Army Award

Five of nine outstanding civilian employees honored at the Fifth Annual Secretary of the Army's Awards Ceremony held Sept. 12 at the Pentagon, Washington, D.C., were recognized for Army R&D activities.

Under Secretary of the Army Stephen Ailes presented the awards.

Top award, the Special Achievement Award, carrying with it the Decoration for Exceptional Civilian Service and $5,000, went to Donald J. Belknap, electronic scientist with the Diamond Ordnance Fuze Laboratories.

Mr. Belknap was honored for his achievements in microminiaturization of incandescent lamps. So small they can be passed through the eye of a sewing needle, the miniature lamps are used in electronic computers and in other DOFL applications.

The Decoration for Exceptional

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Prosthetics devices pioneered by Col Maurice J. Fletcher, recently retired, during 16 years as Director of the Army Prosthetics Research Laboratory have benefited thousands of Army amputees and contributed greatly to the civilian community. He will continue his work in Washington, D.C., as a civilian employee of the National Academy of Sciences. (See page 6.)

Army R&D Newsmagazine

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To improve informal communication among all segments of the Army scientific community and other Government R&D agencies; to further understanding of Army R&D progress, problem areas and program planning; to stimulate more closely integrated and coordinated effort among the widely dispersed and diffused Army R&D activities; to maintain a closer link from top management through all levels to scientists, engineers and technicians at the bench level; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

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Theme of the Month

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future, how this might be turned quickly into useful military technology, and what advanced operational and organizational concepts will demand of this science and technology, is a task requiring all of the talent and capability of the Army's R&D work force.

To be thoroughly grounded in current scientific accomplishments and current military thinking is not enough. Imagination, boldness of thought, logic, and organizational ability must be applied to bring the many pertinent but diverse facts, analyses, judgments, and opinions together, and to insure a constant interchange of their effects, one on the other.

A good beginning has been made on developing this distant objective, on formulating long-range requirements. Technological forecasting, which is the anticipating and recognizing of scientific advances and their military application, has received attention from some of the Army's best scientific and military minds for some time.

Development of a procedure which relates the results of technological forecasting to advanced organizational and operational concepts, under an overall Army program, is now well underway. As the process is practiced and improved, it should provide an increasingly firm basis for the development of Army long-range requirements.

Clear-cut, yet unrestraining Army long-range requirements provide the objectives and the guide to research, that first step in the time-consuming scientific methodology needed to gain a desired end product. It is an all-important step because, unless research is begun, no new end items will ever result. All research is not necessarily desirable research from the Army objectives standpoint. Therefore, research planning, a discrete, active function, must forge the out'ine from which research selection decisions are made.

Research planning provides for choices and selections for all phases of research; for the timely attack on barrier problems associated with supporting research and development; for those aspects of applied research which reflect, less clearly and definitely, gaps and possible rewards in research; and for basic research on the frontiers of science where the selections have the widest scope, least restrictions, and possibly the greatest payoff for the future Army.

The investment in research is small compared to the amount of money spent for developing complex, sophisticated modern weapons and weapons systems. Still, large resources of time, money, critical scientific talent, and elaborately equipped facilities are expended or utilized on research. A great need is recognized for a better understanding of the management, programing, and coordination of the efforts of the various Army R&D agencies who perform or supervise the details of accomplishing research. Greater use could be made of modern scientific analytical techniques to evaluate our programing methods and to suggest areas of improvement.

I have emphasized research planning because I am close to it; but research planning is not done in isolation from the broader overall activity of research and development planning. Continuing diligent and careful evaluation of the long-range military requirements, and of scientific accomplishments and their effect on one another, reveals scientific possibilities becoming military probabilities or definite promises to new military technologies. Various definite applications of research begin to suggest themselves. Systems become more clear in concept. Paths of development begin to be evident.

Under sound research and development planning R&D personnel can process efficiently this more specific knowledge, converting general guidance into more definite direction and permitting the establishment of a productive research and development program. Meanwhile, feedback from all points of the processing goes into more new possibilities and planning.

Research and development planning is simultaneously the link between the future and the present, and between technological possibilities and operational concepts. Long-range R&D planning provides increasingly selective guidance in R&D back toward the present and permits the logical establishment of the R&D programs to which the appropriations are committed.

The foregoing outlines a framework of endeavor and only begins to suggest the detailed complexities of the great task of turning scientific knowledge into military power—the selective gathering of quantities of information; the continuing study and evaluation of requirements, systems, and projects; and the control and coordination of diverse technical and administrative skills.

Critical to our success is a sound overall guiding plan, vigorously implemented and readily updated, which proceeds directly to the R&D objective. Herein lies the great payoff, not only in the elimination of random and wasteful effort, and methodical reduction in lead time, but hopefully in the possibilities of startling innovations in applying science to military needs.

Perfecting and implementing the R&D guidance process is a task demanding diligence, efficiency, and ingenuity at all echelons. It requires the development of imaginative techniques, since the urgent problem of speeding military technology is new to this age. Much has been done. Much remains to be done.

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CRD, DCSLOG Join in Stressing Value Analysis Program

(*Continued from page 1*)

top executives of other Army R&D and logistical agencies have been invited to participate in the seminar.

Value Analysis presentations will be made by officials of four major industrial organizations. Questions such as "What Is Value Analysis?", "Where Does It Apply?" and "Why Value Analysis?" will be discussed by George J. Parker, Director, Administration Division, The Martin Co.

"Value Analysis in Procurement and the RCA Organizational Program" is the subject of a presentation to be made by A. V. Pescatore, Manager of Systems and Procedures, Defense Electronic Products, Radio Corp. of America.

Other RCA executives scheduled to make presentations are Purchasing Agent J. R. McAllister, who will discuss "Value Analysis at the Vendor's Plant," and Purchasing Agent H. J. Morley, who will speak on "Design Reviews, Cost Review Teams and Vendor Technical Assistance."

Vice President R. H. Isaacs of Bendix Corp. has selected as his presentation topics "The Need for Value Analysis in Manufacturing," "Establishment of Objectives and Program," and "Seminar or Task Force Approach."

General Manager of the Eclipse-Pioneer Division of Bendix Corp. Milo F. McCammon is programed for a discussion of "Reporting Results of Value Analysis."

Regional Vice President G. F. Metcalf of the General Electric Co. will discuss "Development of Value Analysis Personnel" GE's L. D. Miles, Manager of Value Services, and John W. Bryant, Manager of Cost Improvement and Value Development, Heavy Military Electronics Department, will discuss Organization, Special Training Requirements, Training Seminars, Pitfalls of Training, and Needs Other than Value Specialists.

The seminar will close with a question and answer period. Presiding will be Brig Gen William F. Ryan, Director of Plans and Management, Office of the Chief of Research and Development, backed up by a panel of experts comprised of top Army and industry representatives. Assistant Secretary of the Army for Installations and Logistics Paul R. Ignatius will make the final presentation.

As a prelude to implementation of the Value Analysis philosophy, 10 staff representatives of the Office of the Chief of Research and Development and the Technical Services attended a 3-week seminar in September at which the General Electric Co. was host. Arranged especially to meet Army requirements, the seminar gave primary consideration to R&D problems.

Watervliet Arsenal, where the pioneering work in Value Analysis within the Army originated, will be host to a similar seminar Oct. 9-20. *(See page 12 for a feature article on the pogram initiated at Watervliet in 1955.)*

Arranged by Chief of Ordnance Lt Gen John H. Hinrichs at the request of General Trudeau, the seminar will be attended by 36 R&D and logistical personnel representatives of design procurement and production activities.

Forthcoming in the near future is a new Army Regulation which will deal with implementation of the Value Analysis Program and prescribe operating procedures and responsibilities.

DOFL Scientist Wins $5,000 Secretary of Army Award

(*Continued from page 1*)

Civilian Service was awarded to four employees:

- Miss Gabrielle Asset, physicist U.S. Army Chemical R&D Laboratories, Army Chemical Center, Md., for outstanding scientific contributions to the Chemical Corps R&D program in the field of aerosols, and the fluid dynamics of particles and air flows.
- Harry S. Beckman, supervisory Ordnance engineer, Office Chief of Ordnance, Washington, D.C., for his outstanding technical leadership in research and development projects since 1952.
- Dr. David McK. Rioch, Director, Division of Neuropsychiatry, Walter Reed Army Institute of Research, Washington, D.C., for his exceptional leadership and achievements in neuropsychiatric research.
- Raul Rodriguez chemical engineer, U.S. Army Engineer R&D Laboratories, Fort Belvoir, Va., for his concept, design and development of equipment for drilling subsurface water wells in glacial ice, making possible sufficient quantities of pure water for daily needs of personnel at Camp Century, Greenland.

The Meritorious Civilian Service Award was presented to Robert L. Niemann, writer, U.S. Army, Japan, for his activities in the area of public relations and establishment of the "Sight for Blind Japanese Children Fund," including securing the interest and support of the Japanese Welfare Ministry in this project.

Donald J. Belknap

Special awards were given to three employees for having submitted the most significant ideas during the 1960 "Operation Searchlight" suggestion campaign. Recipients were William P. Reynolds, marine superintendent, assigned to the U.S. Army Philadelphia Outport; Robert J. Dorabeck, supervisory training instructor, Communications/Electronics Department Fort Sill, Okla.; and Joseph R. Owens, Jr., mechanical engineer, U.S. Army Materiel Support Agency, Fort Monmouth, N.J.

Army Men Present Papers At Alaskan Science Meet

Dr. Carl R. Eklund, Chief of the Polar and Arctic Branch, Earth Sciences Division, Army Research Office, presented a paper on "U.S. Army Cold Weather Research" at the Twelfth Alaskan Science Conference held recently at the University of Alaska, College, Alaska.

Other Army representatives who presented papers were: Lyle B. Hansen, U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), "Temperature Measuring Equipment for Use in Polar Environments"; Dr. Motoi Kumai, CRREL "Electron Microscope Study of Snow and Fog Nuclei"; Arthur V. Dodd, Hq, QM R&E Command, R&E Center, Natick, Mass., "Mesoclimatic Temperature Differences in the Fort Greely, Alaska, Area"; and Capt David Miller, Hq and Hq Co., 1st Battle Group, 9th Infantry, Fort Wainwright, Alaska, "An Investigation of Cold-Injured Soldiers in Alaska."

Dr. Robert W. Gerdell, Chief of the Climatology Branch of CRREL attended but did not present a paper.

The 275 delegates to the conference also viewed the Army film, "Camp Century, Greenland—City Under the Ice." The conference was sponsored by the Alaska Division, American Association for the Advancement of Science.

Army Installing First of 19 Midget Missile Master Systems

Further tightening of the Nation's air defense network is reported from Turner Air Force Base, Ga., where the U.S. Army Signal Corps is installing the first of its 19 BIRDIE systems.

BIRDIE is intended to provide for small-to-medium size important defense areas protection similar to that given the Nation's 10 most critical major areas by the MISSILE MASTER "electronic umbrella." (See December issue, page 2.)

Identified numerically as AN/GSG–5 and AN–GSG–6, Air Defense Artillery Fire Distribution and Control Systems, BIRDIE stands for Battery Integration and Radar Display Equipment. It was developed by The Martin Co. under contract.

The system is integrated functionally with a complex of guided missile batteries and higher command elements to form a fully coordinated air defense force.

Capable of automatic acceptance, generation, processing and distribution of pertinent data, BIRDIE can operate autonomously if higher command inputs are interrupted.

Flexibility of design permits co-utilization of any deployed radar, integration of air defense weapons such as NIKE AJAX, NIKE HERCULES and HAWK and integration with the system identified as SAGE. Housed in 8′ x 8′ x 18′ shelters, the equipment is fully transportable by air, road or rail.

The Turner AFB BIRDIE is a small type, directing firing of a limited number of units. A larger unit stores, processes and updates target information in directing fire of a great many missile batteries.

Efficiency of the BIRDIE is brought out by comparing it with the MISSILE MASTER. The transistorized BIRDIE occupies 97 percent less space, uses 95 percent less electric power and 80 percent fewer personnel.

The first system installed will be operated by personnel of the Army Air Defense Command and will be tied into the North American Air Defense Command. A BIRDIE trainer will be located at the Army Air Defense School, Fort Bliss, Tex.

Announcement of the sites of the other 18 BIRDIE's will be made after each is installed and goes into operation.

"The effectiveness, reliability and relatively low cost make the system a key link in Army Air Defense," said Col J. Wilson Johnston, Chief of Research and Development, Army Signal Corps. "Its timely development clearly demonstrates the versatility of the modern Army in meeting the defense needs of the day."

Redstone Arsenal to Orient Reserves at Missile School

The U.S. Army's first Guided Missile and Orientation School for Reserve Officers will be held at Redstone Arsenal, Ala., Oct. 14-15. Principal speaker will be Brig Gen Richard M. Hurst, Commander of the Army Ballistic Missile Agency.

Conducted by the 3353rd Research and Development Unit, the special school will provide Army reserve officers with an orientation on Army missiles and facilities of the Army Ordnance Missile Command.

More than 300 reserve officers from units throughout the United States are expected to attend the school. A tour of the Army missile development center and a visit to facilities of the George C. Marshall Space Flight Center, located at Redstone, are on the agenda.

First day activities include briefings on the AOMC and its elements at Redstone Arsenal and all the Army's latest ballistic missiles. General Hurst, who heads the Army-civilian team that developed the Redstone ballistic missile and is now working on its successor, will speak at a dinner.

Sessions on the second day will be devoted to more technical presentations on subjects ranging from missile guidance and propulsion systems to maintenance, repair and checkout equipment.

Many of the presentations and briefings will be conducted by officers of the 3353rd, composed of men who work daily with the Army's missiles and in the space activities of the Marshall Center. Others will be led by experts of the Army-civilian team at Redstone.

Dignitaries Invited to 'Pulse Reactor' Dedication

Vice President Lyndon B. Johnson heads the list of dignitaries invited to attend the dedication of the Army's first "pulse" type atomic reactor, Oct. 17, on the grounds of the Army Walter Reed General Hospital's Forest Glen Annex, Md.

Among top Army officials invited to the ceremonies are: Elvis J. Stahr, jr., Secretary of the Army; Dr. Finn J. Larsen, Assistant Secretary of the Army (R&D); Lt Gen Arthur G. Trudeau, Chief of Research and Development; Lt Gen Leonard D. Heaton, The Surgeon General; Lt Gen John H. Hinrichs, Chief of Ordnance; Maj Gen William J. Ely, Director of Army Research, Office of the Chief of Research and Development; and Maj Gen Clinton S. Lyter, Commander of the Walter Reed Army Medical Center.

Former Secretary of the Army Frank Pace, Jr. now president and chairman of the board of General Dynamics, which constructed the reactor, is expected to attend.

The main purpose of the reactor is to enable study of transient radiation effects on electronic devices and systems, to discover how they would withstand atomic attack. It will be operated by personnel from the Diamond Ordnance Fuze Laboratories.

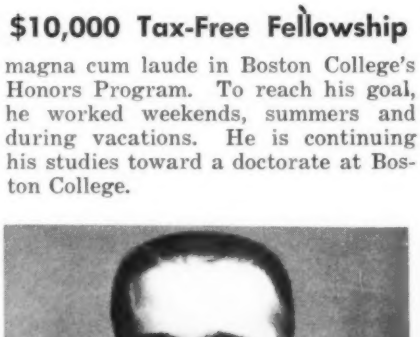
Army Summer Employee Wins $10,000 Tax-Free Fellowship

John J. Maguire, 21, employed for the second successive year as a summer student in the Nondestructive Testing Branch of the Watertown Arsenal Laboratories, Mass., has been awarded a National Defense Graduate Fellowship for doctorate study.

The Fellowship is a 3-year grant which pays full tuition and $10,000 tax free, allocated at the rate of $100 a week during the school term.

Established under the National Defense Education Act, the National Defense Graduate Fellowship Award provides deserving college graduates inclined toward college teaching as a profession the opportunity to pursue graduate studies.

Maguire earned his B.S. degree in physics from Boston College in 1961. Married at the conclusion of his sophomore year, and now the father of two daughters, he was graduated magna cum laude in Boston College's Honors Program. To reach his goal, he worked weekends, summers and during vacations. He is continuing his studies toward a doctorate at Boston College.



John J. Maguire

Top Officals Approve Army-Wide Junior Science Program

Army-wide participation in the Junior Science and Humanities Symposia Program, planned to interest talented students in science and engineering career opportunities in Army R&D, is the goal of action directed through the Technical Services.

Secretary of the Army Elvis J. Stahr, jr., recently approved the program proposed by the Chief of Research and Development to expand the series of successful Junior Science and Humanities Symposia initiated in 1958 by the Office of Ordnance Research (OOR).

Emphasizing the value of the JSHS Program, Lt Gen Arthur G. Trudeau issued instructions to Chiefs of the Technical Services which stated, in part:

"The continued development of technology requires increased efforts to produce breakthroughs in research. The essential raw material for a dynamic and realistic research and development program is an annual increment in the number of scientists and engineers.

"By stimulating outstanding high school students to continue scientific studies, future Army and national requirements of this essential raw material will be met. . . . The U.S. Army Junior Science and Humanities Symposia Program is intended to aid in meeting this requirement. . . ."

The JSHS Program expansion will be accomplished under supervision of the Army Research Office, Arlington Hall, Va., and administered by the Army Research Office-Durham at Duke, N.C. Plans call for approximately 15 symposia during FY 1962.

A typical symposium, usually of three days duration, is attended by several hundred selected high school students and their science teachers. The program might include:

- Presentation of science papers by outstanding high school seniors.
- Observation, at project sites, of research in progress as it is conducted by professionals, in a variety of disciplines, who demonstrate and explain their research goals and methods to small groups of students and teachers.
- A few platform presentations by professionals concerning research work of current general interest.
- A presentation and discussion on the importance of study in the humanities in order to become effective and well-rounded scientists.
- An evening lecture by a scientist renowned for his research accomplishments.
- A conference or discussion among students and professionals to explore career possibilities and technical considerations for young people who are considering careers in the field of science.

Thus, a JSH Symposium provides an exciting forum for participants. It is unusual in that it bridges the gap between formal classroom instruction and the practical application of science and mathematics for immediate purposes. To provide this bridge the JSHS places prime emphasis on bringing the students into firsthand contact with active research on location at industries, universities, and Army laboratories and installations.

Pennsylvania's 28th National Guard Division demonstrates the first test firing of the HONEST JOHN missile by a National Guard Division at Camp Pickett, Va., during training of the 1st Rocket Howitzer Battalion, 108th Artillery.

Symposiums are exciting in that they are not just spectator events; programs make demands upon young people, provide opportunities for presentations of their own research projects, challenge them with the advanced thinking of leading scientists, and encourage informal discussions among the scientists and students.

OOR's first symposium, which was cosponsored by key universities and other institutions in North Carolina and became the pilot project for the JSHS program, adopted as its theme "Research in Progress—Science in the Making." The same theme has been adopted by all subsequent symposia.

Early in 1960 OOR staged two formal presentations, in Washington and New York, to introduce the symposium concept to representatives of colleges, universities, high schools and industries interested in conducting similar programs. OOR also sent descriptive material on the JSHS to over 600 educational and industrial organizations.

In all cases where symposia have been planned or inquiries have been received, local groups have been encouraged to cooperate and sponsor a symposium designed to utilize available facilities and meet local requirements.

By welding the responsible elements of the community into a unified cooperative effort in sponsoring a JSHS, it has been possible to achieve program continuity as well as a number of attendant results—such as elevation of prestige, professional preparation and compensation of teachers; improvement of educational facilities in the school; and strengthening of the scholarship program.

Encouraged by the success of the symposia program, and the enthusiastic support it received, OOR decided in 1960 to investigate means of expanding the JSHS on a national scale. As a basic step, the Advisory Council of the Junior Science and Humanities Symposia was formed to assist in establishing objectives and plans to assure that the program met the needs of today's youth, and to recommend a means for sponsorship on a national scale.

This group of distinguished educators and industrialists endorsed the program without reservation and offered their assistance in furthering its development. In advancing plans for approval of the Chief of Research and Development, the Council recommended that:

". . . the Secretary of the Army's Office establish and support the JSH as an Army-wide project, and that sponsorship of these programs be featured through the many Army Research and Development laboratories throughout the United States."

The Secretary of the Army's reply stated, in part:

"I agree that an Army-wide effort patterned after the Junior Science and Humanities Symposia has tremendous potential for the Army and the Nation. You can be assured of the Army's continuing interest in the expansion of this program."

Members of the Advisory Council include Maj Gen William J. Ely, Director of Army Research; Col George W. Taylor, Commanding Officer, ARO-D; and Col George F. Leist, Chief, Research Branch, R&D Division, Office, Chief of Ordnance.

Prosthetics Pioneer Hailed for 16 Years of APRL Progress

When Col Maurice J. Fletcher recently received the Academy of Achievement's Golden Plate Award, coincident with his retirement from the Army late in August, he ended a career which helped countless thousands of amputees return to normal and useful lives.

From a sprawling cinderblock building at Walter Reed Army Medical Center's Forest Glen section in Maryland, he directed the Army Prosthetics Research Laboratory (APRL) for 16 of his 31 military years.

Devices and techniques developed under Col Fletcher's leadership led one prominent orthopedic surgeon to remark that APRL, "in its short existence has done more in prosthetics of the upper extremities than had been done in the preceeding 5,000 years."

Pourous laminated arm developed at APRL undergoes water spray test to show its absorbency. Perspiration collecting in socket of artificial limbs causes extreme discomfort.

A task almost discouraging in its immensity confronted Col Fletcher when he reported there in 1946. The field of prosthetic research had been so neglected in preceeding years that, at the end of World War II, amputees were hardly better off than were those in the days of "Pegleg Pete" and "Captain Hook."

Military medical authorities were much concerned by the plight of the thousands of war wounded who had lost limbs in the defense of their country. Secretary of War Robert P. Patterson directed the Army to establish seven laboratories to investigate these problems and to provide solutions. The one at Walter Reed was the Artificial Hand Laboratory.

With the arrival of Col Fletcher, then a captain, the seven activities were centralized at Walter Reed under the APRL title. A patent attorney and a designer-inventor in civilian life, he entered the Army in 1930.

APRL's staff at first consisted of two dental technicians, one medical illustrator and a part–time stenographer—a far cry from today's complement of three officers, eight enlisted and 27 civilian technicians.

Equipment on hand at the outset included 24 dressmaker tapes, 12 cast-iron claw hammers, four dozen assorted auger bits, a saddler's vise, four screwdrivers and 2,000 sailmaker's needles. APRL now has a large, fully equipped machine shop, chemical labs, testing devices (many developed by the staff to suit particular needs) and all the equipment and facilities necessary to perform its multi-faceted mission.

One of the first problems tackled was the improvement of artificial hand devices. Up to this time, no one had ever studied the actual requirements of the hand and its method of operation.

First came the development of the split hook, known to the trade now as the APRL hook, a voluntary-closing device which enables the user to pick up an egg without cracking it or to grasp the heaviest, most unwieldy objects firmly and surely.

Next came the APRL hand, which gives the amputee the opportunity to present a normal appearance and to grasp in a normal manner.

Both the APRL hand and the APRL hook are operated by a harness device on the opposite shoulder. Another method of control is that of cineplasty, by which a surgical procedure forms a biceps tunnel through which control cables are inserted.

Color of cosmetic glove is tested so that glove users who know their color number may order replacement without necessity of trip to APRL.

To cover the functional hand, APRL developed the cosmetic glove, one of its greatest morale-lifting achievements. Made of a tough, long-wearing translucent plastic, this glove matches all the contours and lines of the real hand, duplicates its color exactly and can be made with tiny hairs firmly implanted.

Since there will always be a place for the dexterity and versatility of the hook and the appearance and desirability of the hand, they were developed to be quickly interchangeable, according to the need or moods of the user.

One of the most serious problems faced by the amputee with an artificial limb was the extreme discomfort and irritation caused by the accumulation of perspiration in the socket into which the stump fitted.

APRL solved this difficulty with a porous laminate socket, made with a material which will absorb and discharge any amount of moisture. Artificial limbs then could be fitted on persons who had not been able to wear them because of discomfort.

Some of the nonmaterial byproducts of APRL's work are considered achievements almost as important to amputees as prosthetic devices. An example is the elimination of much painful surgery necessary before better design of limbs was achieved. Improved control cables, harnessing materials, fittings, locks and techniques of application have proved invaluable to limb-fitters everywhere.

Dissemination of information on its discoveries to other Government health agencies, universities, civilian physicians and artificial limb manufacturers is another wide area of activity at APRL.

Staff members give courses of instruction periodically at New York University, Northwestern University and the University of California at Los Angeles. They lecture at local, national and international medical meetings and present their latest findings at prosthetics conventions.

The laboratory's investigations have not been confined to orthopedic devices. Much effort has gone into better plastic replacements for damaged facial features, ears and noses. Research is progressing in the field of internal prosthetic devices. Under strenuous testing and development are artificial arteries, tracheas and heart valves.

As the staff works closely with Walter Reed General Hospital's orthopedic and plastic surgeons in connection with external devices, likewise it teams with cardiologists and neurosurgeons in research.

Col Fletcher takes his skill into civilian life with National Academy of Sciences aiming to give further aid to solution of amputee problems. But APRL, the research facility he helped to build as he pioneered in the field, will continue to keep pace with modern medical science in efforts to minimize suffering.

Back-lock on fingers of functional hand are tested to prove fingers can lift 15 pounds 300,000 times.

CmlC Research Reveals Anthrax Vaccine Prevents Most Human Infections

Evaluation of results of a 4-year test of a human anthrax vaccine, developed in line with the national biological defense function of the U.S. Army Chemical Corps, indicates that the vaccine is 92 percent effective in preventing anthrax infections.

Described in a paper titled "Field Evaluation of a Human Anthrax Vaccine," prepared for publication in the *American Journal of Public Health*, the tests were conducted among employees of four mills in northeastern United States. All processed raw imported goat hair.

The vaccine was supplied by Dr. G. G. Wright and associates of the Immunology Branch, Medical Investigations Division of the Army Chemical Corps, Fort Detrick, Md.

Dr. Wright was presented the Exceptional Civilian Service Award in May 1955 for development of "the first non-living anthrax vaccine clinically acceptable for tests in humans. . . ." The anthrax vaccine developed by Pasteur has not proved suitable for humans.

When the test program was initiated at the Communicable Disease Center under contract with the Chemical Corps, the total eligible population of the mills was 1,249 individuals, with 47 percent working in high and 53 percent in low-risk areas.

Twenty-six cases of anthrax were reported among the employees. Four cases occurred in individuals who had incomplete inoculations. Of the remaining 22 cases, 15 occurred in placebo-inoculated employees, 6 in uninoculated persons, and 1 in a vaccine-inoculated employee.

Authors of the paper are Philip S Brachman, Civilian Chief, Investigations Section, Epidemiology Branch, Communicable Disease Center, Public Health Service, U.S. Department of Health, Education and Welfare, Atlanta, Ga.; Dr. Herman Gold, private physician, of Philadelphia; Stanley A. Plotkin and F. Robert Fekety, former Epidemic Intelligence Service Officers, Communicable Disease Center.

McNamara Picks McNamara To Head DOD Supply Unit

Lt Gen Andrew T. McNamara, former Army Quartermaster General, has been appointed to head the Defense Department's new Central Defense Supply Agency.

Set up under a decision announced by Secretary of Defense Robert S. McNamara (no relative) Aug. 31, the new central procurement agency will take over purchase of 956,000 items used in common by the Armed Forces.

Ultimately, the new agency could control an inventory of about $21 billion, Pentagon sources stated.

McNamara was Deputy Commanding General of the 8th Army in Korea when named to head the new agency.

Army's PERSHING missile erected on its mobile transporter-launcher.

25 Raised to Colonels In AE, R&D Programs

Promotional opportunities within the Atomic Energy and Research and Development Programs, by which the Army seeks to recruit and stimulate to advancement top quality officers, are accented by 25 participants selected for Colonel rank.

DA Circular 624-73 dated Aug. 24 announced the selectees and stated that the effective date of the promotions would range from September 1961 through September 1962. Lt Col William A. Dwight was selected from the secondary zone. Primary zone selectees are:

John W. Barnes, Frank A. Bates, Robert H. Bingham, William M. Boggs, Lawrence Bowlby, Joseph T. Brown, Truman F. Cook, C. M. Davenport, Jr., Ned R. Dickson, Edward Dreiss, Mahlon E. Gates, David G. Gauvreau, James G. Healy, G. F. Hesselbacher, Jr., Bruce DesB. Jones, Morton M. Jones, Jr., Richard L. Long, Richard T. Lunger, Thomas W. Mellen, Moris L. Shoss, William W. Stone, Jr., Marvin N. Stanford, William Teir, Wilson R. Reed.

Biochemical Concept Cited as Fuel Cell Research Advance

Except for the concept of the biochemical fuel cell, 1961 has produced no startling developments in fuel cell research, Ernst M. Cohn told participants in the Energy Conversion Symposium of the 12th International Astronautical Congress, Washington, D.C., Oct. 1-7.

In a broad review of progress since he authored the *Second Report on Fuel Cells*, published in December 1960 by the Army Research Office, Mr. Cohn discussed fuel fells research by Department of Defense agencies as well as by industry and private research institutions.

"Although estimates vary," he said, "it is generally agreed that fuel cells, with power outputs ranging up to kilowatts or even megowatts and operating either as primary or secondary power sources, will have a place in the space program, once their feasibility and reliability have been established."

An alcohol fuel cell truck has been ordered by the Post Office Department in Washington, D.C., as a result of research progress by Allis-Chalmers, the company which pioneered the ammonia cells forklift truck and the hydrogen cell tractor, he said. The tractor is now exhibited in the Smithsonian Institution, Washington, D.C.

The presentation covered fuel cell research under Army contract with Speer Carbon Co., the Engelhard Co., Polytechnic Institute of Brooklyn, N.Y., General Electric Co., the California Research Corp., and the Allis-Chalmers Co.

The concept of the biochemical fuel cell, Mr. Cohn said, appears to "be branching out into three distinct directions already:

- Attempts at imitation of biological processes.
- Possible *in vitro* use of biological materials as catalysts.
- Utilization of primitive forms of life to decompose organic material and obtain fuels suitable for use in fuel cells.

"Should the utilization of organic matter ever become practical, this approach would have obvious uses in the disposal of organic waste materials during space flights."

Included in the presentation were a discussion of the current state of research on high-temperature cells, hydrogen cells, nitrogenous and metallic fuels, regenerative systems, new programs, and a summary of main problems.

Mr. Cohn is a specialist in unconventional power sources, Physical Sciences Division, Army Research Office.

Army Joins Navy in Deep Freeze Research

Air support for the U.S. Navy's Operation Deep Freeze in Antarctica, for the first time since the U.S. research program began there seven years ago, is being shared by the U.S. Army.

Army ground elements have been provided in past years but air support has been a joint responsibility of the Navy and Air Force. When the current expedition was launched recently, two HU-1B Iroquois turbo-powered helicopters were furnished by the Army Transportation Board.

The Iroquois is used in ground control of aerial photography in conjunction with a topographic survey because it can reach altitudes not attainable by older model helicopters. It enables crews to land in previously inaccessible mountain areas and establish ground "fixes" which will be used later in conjunction with aerial photography for mapping.

Dr. Paul A. Siple, Scientific Advisor, Army Research Office, OCRD, heads the list of 22 Army participants in Operation Deep Freeze. He was Scientific Station Leader at Wilkes Station at the South Pole in the International Geophysical Year.

Ten men have been supplied by the Army Transportation Board from Fort Eustis, Va., three by the Engineering Research and Development Detachment at Fort Belvoir, Va., three by the Cold Regions Research and Engineering Laboratory (CRREL) at Hanover, N.H., two by the Signal Corps, Fort Monmouth, N.J., and three by the Transportation Environmental Operations Group (TREOG), Fort Eustis.

The Army Transportation Board group is composed of four pilots and six supporting personnel. The Belvoir ERDL contingent is made up of one geologist and two civil engineers who are doing research work in the basic properties of snow and ice.

Activities of the CRREL scientists in the Operation include study of snow densification and the properties of snow and ice. CRREL is developing a deep core thermal drill under funds provided by the National Science Foundation.

The 2-man research team from the U.S. Army Signal Laboratory, Fort Monmouth, N.J., is exploring communications problems.

Under the command of Rear Adm David M. Tyree, Operation Deep Freeze began in early September and is scheduled for completion in March 1962. A group of ships, including icebreakers, a cargo ship and a tanker, will start toward Antarctica in November.

Army WO George W. Fowler of the Office of the Chief of Transportation, Fort Eustis, is navigator for the Navy for the third straight year. Maj Antero Havola, who in January this year made history by leading the first U.S. expedition more than 800 miles on an overland traverse and staking out a "safe highway" to the South Pole (See March Issue, Page 3), is Trail Operations Officer for the U.S. Navy Support Force, Antarctica. He will be replaced during the Operation by Capt Wilbur E. Martin. All of these men are from TREOG.

The main purpose of Operation Deep Freeze is to support the U.S. Antarctic Research Program (USARP), sponsored by the National Science Foundation. An NSF spokesman said, "We have always enjoyed excellent support from Army personnel engaged in the Operation."

Commenting on the Army helicopters being used this year, he said, "These aircraft, carrying USARP topographic engineers, should provide us with a type of logistic support not previously possible."

He added, "Our relationship with the Army has been both to sponsor Army research in Antarctica and to benefit from the excellent support of Army operating personnel."

Aside from aiding the Navy in Operation Deep Freeze, the use of the new helicopters affords the Army an opportunity to test the aircraft under extreme environmental conditions in altitudes up to 15,000 feet.

Fellowships Show Attention To Nation's Scientist Need

Increasing attention given to the Nation's expanding need for scientific education is reflected in findings by the U.S. Office of Education that more than half of the total value of all graduate fellowships granted by U.S. universities is in the fields of the physical sciences and mathematics.

Statistics show that 20,811 graduate fellowships were granted in 1959-60 with a total value of $35,040,578. Fellowships for sciences and engineering were valued at $19.424,354.

The largest number of fellowships in any scientific field, 2,032 with a value of $3,594,827, was in chemistry. Physics had 1,265 fellowships valued at $2,560,789, and mathematics 1,122 fellowships valued at $2,469,314.

The figures are contained in a new Office of Education publication, "Doctoral Study, Fellowships and Capacity of Graduate Schools," available at 45 cents a copy from the Government Printing Office, Washington, D.C. Estimates of additional fellowship capacity exceeded 20,000, more than half of which could have been devoted to students of sicence and engineering had the necessary financial support been provided.

Quartermaster Adopts Deet As Versatile Insect Repellent

The Army Quartermaster Corps Technical Committee has officially adopted "Deet," a new insect repellent.

Being issued to field personnel, the greaseless substance has a faint, relatively pleasant odor and will repel most insects, including mosquitoes, fleas, chiggers, ticks, deer flies, and biting knats. It is effective under conditions of heavy rainfall and extreme heat.

Deet was developed by the U.S. Department of Agriculture with Army medical research funds. It replaces the Army's previous standard repellent, M-2020.

Signal Corps Buys Weather Equipment Simulators

Production of 75 units of a "Weather Equipment Simulator," which plugs into ground-based electronic weather-computing systems and instaneously checks out the accuracy of their operations, has been ordered by the U.S. Army Signal Corps.

First of its kind, the portable testing device is designed to ensure that meterological information radioed to earth from balloon-borne radiosondes (at altitudes up to 24 miles) will be correctly recorded and interpreted by the receiving instrument.

Since weather-computing systems are used at globally dispersed U.S. defense installations, the Weather Equipment Simulator is intended to guard against inaccuracies of meteorological information needed to help determine strategic and tactical deployment of planes and troops, effective operation of radar and guided missiles, and calculations of nuclear fallout dispersion.

The Simulator is expected to prove valuable to the U.S. Weather Bureau and private meteorological services which employ weather-computing systems in compiling forecasts on which business and industry make multi-million-dollar decisions involving weather as a factor.

The new device measures 10" x 10" x 12", weighs only 35 pounds, and is operated by one man. It imitates the signals which would be received from the balloon-borne radiosondes and feeds simulated weather data (temperature, humidity, air pressure, wind force and direction, etc.) into a radio weather information set, the ground-based receiving and computing apparatus. Its instrument panel instantaneously "parrots" exact readings of the simulated data it has received.

A contract for the Weather Equipment Simulator units has been awarded to Dynamics Corp. of America for manufacture by Reeves Instrument Corp., Farmington, N.J., Division.

Ingenuity Slashes Cost of Solving Research Problem

Solution of a $500,000 problem of automatic data processing at a cost of $10 000 through the exercise of ingenuity is reported at the Waterways Experiment Station (WES), Vicksburg, Miss.

Francis P. Hanes, one of the project technicians, tells how the notable economy was achieved in an article submitted to this publication. Well written, the article is not carried in its entirety because it is considered too technical except for readers skilled in automatic data processing.

While lacking the high-speed characteristics of the expensive commercial equipment that might have been used at an estimated cost of about $500.000, the system evolved at the WES proved more than adequate for the specific measurements involved. Provisions have been made in the equipment devised to allow data reduction from magnetic tape on a fixed-time base. Mr. Hanes stated:

"The particular requirement for this data acquisition system came in connection with an automated measuring system developed for use in Army R&D work involving vehicle mobility. Fundamental research in this field has been facilitated through use of the cone penetrometer for measuring soil strength.

"Correlation and analysis of a vast number of cone penetrometer force-versus-distance measurements required in the research program form the basis for providing the device. . . .

"The automated measuring system consists of a digital voltmeter which is used to convert the analog load cell signal to 3-digit numbers ranging from 000 to 999. The read-out and intermediate storage function is accomplished with a paper tape punch using 8-channel tape code. . . .

"The system is considered to offer an economical solution to a specific data-gathering problem. Fringe benefits include ability to digitize analog signals through use of a magnetic tape recorder.

"The system should be applicable to numerous instrumentation problems where the limitations imposed can be offset by the lowered cost. The technique was evolved by the author and the equipment was supplied by Electronic Controls, Inc., Stamford, Conn."

SC Uses Computer to Cut Missile Forecast Errors

Army Signal Corps scientists have cut in half the average mileage error in the predictions of the trajectory and impact of sounding rockets by using a new high speed computer at White Sands Missile Range, N. Mex.

The Signal Missile Support Agency at White Sands received one of the first available solid state large-scale computers in August, 1960. Mathematicians have taken full advantage of this powerful tool in making more accurate trajectory and impact predictions of such unguided sounding rockets as the Aerobee-Hi.

Hand calculations and small computers were used in 13 firings in 1960. Average prediction error then was 12.4 miles. In 1961, with the new computer, the average prediction error was reduced to 6.8 miles. Maximum prediction error in 1960 was 25.4 miles, as compared with 14.0 miles in 1961. Minimum prediction error in 1960 was 8.0 miles, and in 1961, 0.0 miles.

The advent of high altitude rockets carrying instrument packages for upper air research has necessitated more accurate predictions of the trajectory and impact of rockets to insure impact in proper range areas.

Theoretical investigations have revealed that a major determining factor of the trajectory and resulting impact of an unguided rocket is the wind force encountered during the burning period. Future plans include use of an even more sophisticated theory that will involve evaluation of ballistic equations using current meteorological parameters such as wind, temperature, and density profiles. Mathematicians are now working on the evaluation of this theory on the computer.

Weather Experts Decide More Research Needed to Design Proper Equipment

Further research and study of the atmosphere and its circulation as a precedent to development of meteorological equipment was emphasized recently at the sixth meeting of The Group of Experts on Exterior Ballistics in Paris, France.

Mrs. Frances L. Whedon, meteorologist in the Geophysics Branch, Earth Sciences Division, ARO, attended the meeting with three other Army delegates: Lt Col J. R. Buntyn, Antiaircraft and Guided Missile School, Fort Sill, Okla., who was principal delegate from the United States; Miss Merle Good of the Office, Chief of Ordnance; and O. P. Bruno, Ordnance Ballistic Research Lab.

Representing the other services were Lt Col John Highly of the Air Force and Arthur Jones of the Navy.

The Group, which reports to the Armament Committee of NATO, concentrated on the ballistics of tube artillery and ballistic missiles, with two areas of interest: the meteorological aspect and ballistic correction.

"There is an extensive program of studies planned, concerned particularly with atmospheric properties and circulations," said Mrs. Whedon. She noted that "meteorological equipment now in use is considered adequate for present artillery purposes."

Engineer Wins Award for Film Discovery

A discovery made by an Army civilian electronic engineer while working with 16 mm. sound motion picture film has been rewarding both to him and the Army.

Such films are frequently provided with a narrow magnetic stripe covering half of the regular optical sound track so that a second sound track—usually in a foreign language—can be recorded, thus extending the usefulness of Army training films. The narrowness of this stripe and the loss of half the width of the optical track often result in very poor sound quality in both optical and magnetic sound tracks.

George Lewin, civilian electronic engineer employed at the Army Pictorial Center, Long Island City, N.Y., discovered that the magnetic stripe is substantially transparent to infrared light. By utilizing the infrared sensitivity of the lead-sulfide photocells used in the Army JAN projectors, he was able to stripe the full width of the optical track and yet obtain better optical sound quality than was possible from the half-width track. Moreover, the magnetic sound quality is greatly improved because of its doubled width.

Another application of the discovery is in the production of stereophonic recordings on 16 mm. motion picture film, since the optical and magnetic tracks can be reproduced simultaneously through separate loudspeakers.

Mr. Lewis documented his discovery in reports to the Army Signal Research and Development Laboratory, and subsequently was given permission to present papers on it before the Society of Motion Picture and Television Engineers. These were published in the SMPTE *Journal*, and earned for him the *Journal* award for "Best Paper of the Year."

The papers of his discovery also helped earn for him the Samuel Warner Memorial Gold Medal Award for Achievement in Motion Picture Engineering, a fellowship in the Society of Audio Engineers, a Department of the Army Certificate of Achievement, and a commendation from the Chief Signal Officer.

Recently, Mr. Lewin was granted a patent on the utilization of his discovery. The patent, titled "Multiple Sound Tracks," provides for free usage by the U.S. Government.

George Lewin is congratulated by his Commanding Officer Lt Col Robert B. Randle on patent, many awards granted for movie sound track device.

Chief of Engineers Announces Personnel Shifts

Lt Gen W. K. Wilson, Jr., Chief of Engineers, recently announced the following changes of assignments:

Maj Gen S. R. Hanmer, Deputy Chief of Engineers for Military Operations, to be Commanding General, U.S. Army Engineer Center and Fort Belvoir, Va.

Maj Gen Alden K. Sibley, Deputy Chief for Logistics, Military Assistance Advisory Group, Vietnam, to be Deputy Chief of Engineers for Military Operations, Washington, D.C.

Brig Gen H. K. Eggleston, Director of Military Supply, Office of Chief of Engineers, to be Deputy Chief for Logistics, MAAG, Vietnam.

Brig Gen Robert G. MacDonnell, Division Engineer, U.S. Army Engineer Division, South Pacific, San Francisco, Calif., to be Director of Military Supply, Office of Chief of Engineers. His successor is Col A. H. Frye, Jr., former Deputy Director of Military Construction, Office of Chief Engineers.

Brig Gen W. C. Hall, Director of Personnel, Office of Chief of Engineers, to be Director of Research and Development, Office of Chief of Engineers, Washington, D.C. His successor is Col R. S. Kelley, reassigned from Chief, Military Personnel Division, Office of Chief of Engineers.

Col George H. Walker, Engineer, U.S. Continental Army Command, Fort Monroe, Va., to be Assistant Commandant, U.S. Army Engineer School, Fort Belvoir, Va. The President has submitted the nomination of Colonels Frye and Walker for promotion to the rank of Brigadier General.

MIT Lab Marks 15th Year as Joint Service Effort

When the Massachusetts Institute of Technology's Research Laboratory of Electronics (RLE) recently held its 15th anniversary celebration, several Army scientists could look back with satisfaction to their role in its origin and growth.

After the close of the World War II Radiation Laboratory, the three military services queried MIT about its interest in continuing a peace-time research program in electronics of general defense interest. MIT was strongly in favor of the idea and in 1946, RLE was established.

Dr. J. A Stratton was the first director, assisted by a Joint Services Advisory Committee made up of Dr. Harold A. Zahl, U.S. Army Signal Corps, Chairman; Dr. E. R. Piore, Office of Naval Research; and J. E. Keto, U.S. Air Force.

RLE soon became the pattern for similar Joint Service effort in other schools, such as Harvard, Columbia, Stanford, Illinois, etc., and later the Polytechnic Institute of Brooklyn, the University of California and others.

Over the years, RLE's directorship has changed. Dr. A. G. Hill took over when Dr. Stratton assumed the role of MIT's Provost and later President. Following Dr. Hill, when he moved to the Directorship of Lincoln Laboratory, came Dr. J. B. Wiesner. When Dr. Wiesner became President Kennedy's Scientific Adviser, Dr. H. J. Zimmerman assumed the top post.

The anniversary celebration was held at the MIT Faculty Club. Speakers included Dr. Wiesner, MIT Vice President James McCormack (Major General, USAF, Ret.), Dr. Zimmerman, and Dr. J. C. Slater. Congratulatory telegrams were also read from Dr. Stratton and Dr. Hill who were on extended travel.

Speaker for the Services was Dr. Zahl who presented past members of the Joint Services Advisory Committee. Present members of the Committee are Dr. E. M Reilley, of the Army Signal R&D Laboratory, Chairman; Dr. A. Shostak, Navy; and Dr. P. S. Johnson, Air Force.

In RLE's 15 years of existence, personnel have published 354 formal technical reports and 1,040 papers, presented before technical societies, indicating research which contributed to the awarding of 384 masters' degrees, 93 Sc. D's and 150 Ph. D's. Classified research which was carried on during the Korean conflict was later separated from RLE and became the basis for the Lincoln Laboratary.

Contracts Indicate Urgency Of PERSHING Missile R&D

Army contracts totaling $20,760,000 recently awarded to the Martin Co., of Orlando, Fla., for further work on the PERSHING ballistic missile system included $12,760,000 for research and devolpment, and $8,000,000 for production of the missile system.

The award increased the allocation in August to the Martin Co. to approximately $91,000,000.

The Army Ballistic Missile Agency, at Redstone Arsenal, Ala., is supervising system development and production. The Birmingham Ordnance District administers the contract.

NIKE ZEUS Meets Firing Test With New Motor in Main Stage

In a test of a new motor used in its main stage, a two-stage NIKE ZEUS anti-missile-missile was fired successfully. The new motor employs a higher performance solid propellant than that used in previous tests.

Army officials in charge said all test objectives were met. These also involved studying missile structure and the ground electronic equipment composing the missile's fully automatic guidance system, which controlled the missile throughout the test.

YHU-1D Copter Advances Into Flight Test Phase

Turbine-powered aircraft development, in line with the Army 10-year aircraft improvement goals announced in the August issue of this publication, progressed notably with the recent first flight of the YHU-1D helicopter.

Pronounced ready for Phase 1 of the flight test program, the YHU-1D will be called the HU-1D when placed in production by the Bell Helicopter Co.

Powered by a Lycoming T-53-L9 engine of 1,100 shaft horsepower, the new aircraft has 220 cubic feet of cabin space (as compared to 140 for its predecessor, the HU-1B). It will carry a pilot and 12 fully-equipped battle troops, 50 percent more than the HU-1B.

Designed for Army requirements for brushfire wars—patrol, casualty evacuation, troop transport and cargo hauling in cabin or by external sling load—the HU-1D will feature the same compactness, low silhouette and transportability by cargo plane as earlier models in the record-setting Iroquois series.

An earlier model in 1960 set six world helicopter flight records, breaking two Russian-held marks. That ship flew more than 158 m.p.h. and climbed more than 19,000 feet in 8 minutes 7.1 seconds. The HU-1D will retain dynamic components of the HU-1B and use existing structural hardware to facilitate production tooling techniques.

Services Join in Sponsoring Symposium on Luminescence

Scientists from various parts of the Western World will attend a symposium on luminescence to be held in New York City, Oct. 10-13, under the joint sponsorship of the Army Research Office, the Air Force and the Office of Naval Research.

Invitations were extended to scientists active in this area of research in England, France, Holland, the Federal Republic of Germany, Jesusalem and Japan.

Arrangements in connections with the symposium are in charge of Prof. H. P. Kallman of the Department of Physics at New York University, which organized the gathering.

Army Sets Up R&D Detachment At Wright Patterson Air Base

Establishment of an Army Research and Development Detachment at Wright Patterson Air Force Base, Ohio, was announced in OCRD Bulletin No. 44, Aug. 1, 1961.

Its mission is "to represent the Department of the Army in the development of the C-141 aircraft system and maintain coordination with the Chief of Transportation, The Quartermaster General and the Commanding General, United States Continental Army Command, to insure that technical requirements are considered."

PLASTEC Role Grows as DOD Finds New Uses for Plastics

Increasing significance of plastics in military application has given the Plastics Technical Evaluation Center (PLASTEC), Picatinny Arsenal, Dover, N.J., an even more important role than anticipated when it was established by the Department of Defense in 1960.

Until recently, for example, glass-reinforced plastic was not considered an important material for missile casings because of the problems of fabrication of parts and adequate inspection techniques.

High strength-to-weight ratio advantage that plastics have over conventional materials has contributed to the current increase in the application of plastics to advanced missile casing designs.

Paul S. Forsyth, Materials Division, Office, Director of Defense, Research and Engineering, said recently that "PLASTEC has performed its duties beyond expectations in evaluating current research and engineering technical results.

"It is expected that plastics in the rocket motor case field and in other missile hard parts applications centering around ablative nose cone and rocket nozzle applications will increase substantially in future generations of missiles."

The main purpose of PLASTEC is to serve military organizations and their contractors as a clearing house for information on plastics technology. PLASTEC was established to collect, evaluate and disseminate the latest reliable information on plastics developments to more than 5,500 companies in the United States and many hundreds of Department of Defense agencies and contractors either in the plastics business or using plastics products.

Since it is impossible for each engineer to read all the technical literature in his field, PLASTEC is providing a more effective way of getting the evaluated facts to the engineers. Publications containing extracts of significant work on various subjects are disseminated. Specialists make frequent personal contacts with technical personnel in Government and industry. Prompt technical replies are given to inquiries from design engineers.

One of the more important concerns of PLASTEC is to help reduce the lead time of military items from the design stage to the hardware stage. The Center disseminates timely information among Government agencies and their contractors and promotes a cooperative interchange of data within the military departments of the Department of Defense.

In performing their services PLASTEC's staff of specialists concentrate on four areas of plastics technology: structural, electrical, packaging and mechanical.

Evaluations of plastics in these areas are disseminated in two ways: answering specific inquiries and publishing reports.

Reports are of two general types. Most significant is the formal or state-of-the-art type, which contains the best available information on a particular topic. Examples are "Glass Flake Laminates," "Recent Developments in Casting Resins as Applied to Electrical Encapsulation," and "Filament Winding Techniques."

The second type of report is the informal or less authoritative memorandum, which does not attempt to cover an entire subject. Several memoranda on the same subject form the basis for a state-of-the-art report.

PLASTEC reports and inquiry service are furnished without cost to all Department of Defense agencies, their contractors and suppliers, those requiring information to become contractors, and universities, technical libraries, NASA and AEC. Qualified requesters may obtain PLASTEC reports from the ASTIA Document Service Center, Arlington Hall Station, Arlington 12, Va. Unclassified information is available to the public through the Office of Technical Services, Department of Commerce, Washington 25, D.C.

PLASTEC's specialists acquire their information in various ways. They not only read pertinent literature but they also make frequent trips to plastics plants and laboratories, and attend technical society meetings.

The PLASTEC specialist, beside drawing on his own knowledge of a subject, can rely on the technical data available in PLASTEC's files. He can also consult the staff of the Ordnance Corps Plastics and the Packaging Laboratory at Picatinny Arsenal. The accessibility of this Laboratory was one of the important reasons for locating PLASTEC at Picatinny.

PLASTEC, under the direction of Harry E. Pebly, Jr., is continuing to ferret out the latest developments in plastics, evaluating them for application to military problems, and searching out suitable areas for such applications—thus carrying out the mission for which it was established.

The first model of "Mauler," an Army mobile air defense missile system under development, is examined by Secretary of the Army Elvis J. Stahr, jr., (left) who received the model from C. Rhodes McBride, vice president of General Dynamics Corp. of Pomona, Calif., development contractor for the system. Mauler is designed to destroy high performance enemy aircraft and short-range enemy ballistic missiles and rockets in the battle zone. The unit will be mounted on a self-propelled chassis and will contain its own power supply, target detection and electronic computer fire-control equipment, and a basic load of missiles. Capable of firing while moving, it will be air-transportable.

Ordnance Corps Proves Merit of Value Analysis Techniques

By Henry Maloy, Watervliet Arsenal

A down-to-earth approach to the problem of soaring industrial production costs which has enabled the Ordnance Corps to reduce its expenditures for weapons by some $16,000,000 during the last five years may soon be applied throughout the Army research and development establishment.

Favorable reaction has been reported to a presentation on the Value Analysis system of cost-cutting made recently to top Army leadership by the Office of the Chief of Ordnance. Participating in the presentation were representatives of Watervliet Arsenal and the Army Ordnance Missile Command. Since 1955, VA is credited with saving $1,005,943 at the New York cannon development center.

Edward O. Greeson, Arsenal Commodities Branch Chief, described VA before an audience including Lt Gen Arthur G. Trudeau, Chief of Research and Development, Representatives of the Deputy Chief of Staff for Logistics, and the Chiefs of all the Technical Services.

As defined by Greeson, Value Analysis is fundamentally an ORGANIZED WAY OF THINKING, with the twin objectives of FUNCTION and VALUE ever the alpha and omega of the value analyst. It is an objective appraisal of functions performed by parts, products, equipment, procedures, services—anything, in short, that costs money. It seeks to obtain the necessary function for the lowest cost.

The functional approach of Value Analysis is most simply characterized and defined by five basic questions applied to any item of cost: What is it? What does it do? What does it cost? What else will do the job? What does *that* cost?

By fleshing out these bare bones of self-interrogation and self-brainstorming with other tested techniques evolved through experience, the value analysts have created a system that has saved up to 80 percent in the costs of Ordnance items, ranging from a deburring file to a missile warhead container.

Before Greeson cited chapter and verse from project reports to illustrate the processes which accounted for Watervliet's procurement savings, he briefed his listeners on the background and history of Value Analysis.

Generally credited in its present form as an outgrowth of a program started in 1947 by the General Electric Co., Value Analysis actually was first used during World War II. Like many other innovation, it was at first, a sort of byproduct.

When wartime shortages forced designers to use substitute materials and designs, they found that, while the ersatz items sometimes couldn't match the original, very often they were just as good. Occasionally the substitutes proved better than the originals and, surprisingly enough, lower in cost.

Noting this phenomenon, top GE officials decided to see if there was a way the process could be consciously and regularly employed to attain a great frequency of such product efficiency by using substitute materials to take over functions of the more costly standard materials.

Such a way was found when GE Vice President Harry Erlicher asked Lawrence D. Miles, staff engineer at the Schenectady, N.Y., plant to investigate the possibilities. Spearheaded by Miles, the new method—which he and Erlicher had now dubbed Value Analysis—scored its first "spectacular" with a project that saved more than $200,000 a year and turned a low-sales item into a huge commercial success.

Success led to an increase in GE's Value Analysis staff, continued impressive results, and adoption of the system by other top industrial firms—RCA, Westinghouse, IBM and others.

VA influenced the Ordnance Corps in 1955 when Greeson and M. E. Gilchrist visited the nearby Schenectady plant to see if the system could be used as a weapon in Watervliet's war against high costs. What they heard and saw at GE so imbued the pair with the VA gospel, they immediately launched a missionary campaign at the Arsenal.

Within a year, the idea of Value Analysis had been sold to the then commanding officer, Col E. S. Mathews, and other top management, a work unit had been set up, and Value Analysis was in business, profitably, at Watervliet.

To show how Value Analysis conducts its business at Watervliet, Greeson described a typical project—improving the muzzle plug for the 155 mm. gun and howitzer. Used for years by Ordnance to seal and protect the muzzle of the weapon from the elements and from misuse, this item was fashioned from steel, brass, aluminum and rubber. It maintained the close tolerance necessary for tight fit. It also cost $31.15.

Assigned to produce a muzzle plug providing the same sealing and protective qualities, the same close tolerance—but costing considerably less money—value analyst Arless Mosher first asked himself the five basic questions of VA. He then attacked the problem with a 3-phase offensive in each of the vital job-plan areas—speculation, analyzing, program planning. Methods he used have become watchwords at Watervliet—Blast, Create, Refine.

In the initial Blast phase, the traditional, the typical, the beaten-track approaches are literally blasted from the analyst's mind. Following this self-inflicted brainwashing, the only aspects of the problem remaining are the twin objectives of function and

Col Walter M. Tisdale, Watervliet Arsenal Commanding Officer, and Edward O. Greeson regard two 155 mm. gun muzzle plugs: Traditional plug machined from metals and rubber, left, cost $31.15; neoprene rubber plug at right, a Value Analysis product, costs only one-fifth as much, functions as effectively.

idea needlers

when stimulation is required

How much of this is the result of custom, tradition, or opinions?
Why does it have this shape?
How would I design it if I had to build it in my home workshop?
What if this were turned inside out? reversed? upside down?
What if this were larger? higher? longer? wider? thicker? lower?
What else can it be made to do?
What other power would work better?
Where else can this be done?
What if the other were changed?
Suppose this were left out?
How can it be done piecemeal?
How can it appeal to the senses?
How about extra value?
Can this be multiplied?
What if this were blown up?
What if this were carried to extremes?
How can this be made more compact?
Would this be better symmetrical or asymmetrical?
In what form could this be?
Liquid, powder, cast, or solid?
Rod, tube, triangle, cube, or sphere?
Can motion be added to it?
Will it be better standing still?
What other layout might be better?
Can cause and effect be reversed? Is one possibility the other?
Should it be put on the other end or in the middle?
Should it slide instead of rotate?
Demonstrate or describe by what it isn't.
Has a search been made of the patent literature? trade journals?
Could a vendor supply this for less?
How could this be made easier to use?
Can it be made safer?
How could this be changed for quicker assembly?
What other materials would do this job?
What is similar to this but costs less? Why?
What if it were made lighter or faster?
What motion or power is wasted?
Could the package be used for something afterwards?
If all specifications could be forgotten, how else could the basic function be accomplished?
Could these be made to meet specifications?
How do our competitors solve problems similar to this?

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value. By forcing the mind into the regions of the unexplored, the blasting process yields the greatest dividend. It breaks down the concept of conventional saving of 5 or 10 percent and prepares the mind for the possibility of a breakthrough with revolutionary results.

In the case of the muzzle plug, VA blasting revealed that the costly combination of metals, essential at the time the original plug was designed, no longer was needed. Technological progress had outdated both material and process, offering alternatives which could achieve both function and value at far less cost.

The question for the correct alternatives is the essence of the second phase. To create, the analyst sweeps away the blasted traditional concepts, and allows his mind free flight in the stratosphere of imagination, in the realm of the new, the untried.

Freed from the old concept of the muzzle plug, Mosher now considered the alternatives—all the materials from which it might be fashioned, all the methods by which it could be made. Could the item be made of wood, of plastic, fabric, another metal? Could it be a cap, or a plate instead of a plug?

With these considerations came other questions. Was the material available? Was it cheaper than the original? Was an alternative process economically feasible? All the aspects of all the materials and methods were examined, analyzed, and tested.

Ultimately, all the alternatives, save one, were rejected, and the creative analysis of the second phase ended with this conclusion: A simplified, satisfactory plug could be made of neoprene rubber.

In the final, or Refining phase, the analyst must resolve the promising idea conceived in phase two into a workable solution. Acting as a devil's advocate, he must subject his brainchild to a rigorous regimen of questions and objections.

To prove his concept, Mosher then directed a barrage of such objections and questions at his decision to use neoprene. As he admitted or disproved objections, answered questions, made compromises and adjustments, the analyst was literally refining the idea until all that remained was the proven, workable finished product of this creative thought.

The refining process considered the neoprene plug in terms of design, shape, dimensions, appearance, strength, life expectancy, Government specifications, and the rigors of inspection, before deciding it satisfied the Value Analysis objectives—value and function.

Once these requirements were satisfied, the 155 mm. had a new muzzle plug, made of neoprene rubber—equally effective as the original —and costing just $6.25, for a saving of $24.90 per item!

This 3-phase process, of course, is not as simply executed as this case history might imply. Actually, 20 Value Analysis techniques are brought into play in carrying out the three phases. But each of these tools is allied with one or the other of the three main attack forces—Blast, Create, Refine.

Equally important as Watervliet's own Value Analysis accomplishments are its missionary efforts throughout Ordnance. Since 1956, Arsenal value analysts have spread the word at workshop seminars, and through information briefings for its own and other Ordnance personnel.

Altogether, 2,475 Ordnance employees have heard the briefings, while 400 more have attended seminars at the Arsenal. Afield, expeditions such as Raymond Spenard's 60-day educational mission in 1959 to 17 Ordnance agencies have helped establish VA units now flourishing on their own.

The list of successful VA projects is as varied as Ordnance materiel itself. To cite just a few:

- *Watervliet's use of a stamping in place of a casting for the 106 mm. rifle bore sight which cut that item's cost from $3.31 to 36 cents.*

(Continued, next page)

Brig Gen Hall Assigned As CE Director of R&D

Brig Gen William C. Hall has been reassigned as Director of Research and Development, Office of the Chief of Engineers.

Previously Director of Personnel, Office of the Chief of Engineers, since 1959, General Hall was born in St. Louis, Mo. Commissioned in the Infantry in 1931 upon graduation from the U.S. Military Academy, he was

Brig Gen William C. Hall

transferred to the Corps of Engineers in March 1936.

From 1931 to 1938, he served with troops, received a master of science degree in Civil Engineering from the University of California, and attended The Engineer School.

In Washington from 1939 to 1943, he served as Assistant to the Resident Member, Beach Erosion Board, and later as Assistant to the Chief of the Intelligence Branch, Office of the Chief of Engineers.

Following attendance at the Command and General Staff College, Fort Leavenworth, Kans., General Hall served as Commanding Officer, 1306th Engineer General Service Regiment.

From 1953 to 1955, General Hall was Engineer, and later Assistant Chief of Staff, G-4, of the Second U.S. Army at Fort George Meade, Md. After attending the National War College for a year, he served as Assistant Chief of Staff, J-4 (Logistics), Alaskan Command, 1956 to 1959.

Gen Doan Succeeds Gen Hartford

Brig Gen Howard W. Doan, Director of Personnel and Training in the Office of The Surgeon General, has been named Deputy Surgeon General, succeeding Maj Gen Thomas J. Hartford, who was retired Sept. 30 after more than 30 years of service.

Col Edward C. Dunn, nominated by the President for promotion to the grade of brigadier general, has been assigned as Deputy Commander of the U.S Army Training Center at Fort Carson, Colo., effective this month.

Missile Veteran Becomes Pacific Range Deputy CO

Col John G. Redmon recently was assigned as Deputy Commander, Army, at Pacific Missile Range Headquarters, succeeding Col Bernard R. Luczak.

As the senior Army officer assigned to the Range he will be responsible for conducting tests of Army missiles. A 1941 graduate of the U.S. Military Academy, he came to Point Mugu, Calif., from studies at the Industrial College of the Armed Forces at Fort McNair, Washington, D.C. Col Luczak is attending the National War College, also at Fort McNair.

Col Redmon was doing research in guided missiles in 1946 as Assistant Chief of the Rocket and Guided Missile Branch of the Research and Development Division in the Office of the Chief of Ordnance, U.S. Army.

Upon completion of this tour of duty in 1948, he was a student at the Massachusetts Institute of Technology and earned a master's degree in mechanical engineering. More recently he has been Chief of the Ordnance Mission at the White Sands Missile Range, N. Mex., Ordnance Representative to the Canadian Army, and Assistant Director of Production at Watertown Arsenal, Mass.

AEC, ARPA Take Part In Army Materials Meet

Representatives of the Atomic Energy Commission and the Advanced Research Projects Agency discussed AEC and ARPA programs in materials research and science at a recent 2-day meeting of the Army Materials Advisory Committee.

The U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., was host to the meeting.

Dr. Donald K. Stevens presented a paper on "Materials Research and Development in the Atomic Energy Commission," and Charles F. Yost discussed "The Advanced Research Projects Agency Program in Materials Science."

Other scheduled presentations included "A Castings Research and Development Program in the National Interest" by P. A. G. Carbonaro, Watertown Arsenal Laboratories, and "Integration of the Organic Materials Segment U.S. Army R&D Program" by Dr. G. R. Thomas, Quartermaster R&E Command. Task Groups reported on "Programing and Planning," "Basic Research," Information and Classification Activities," and "Equipment."

The committee also discussed a proposal to establish task groups for periodic review of technical plans on metallic, inorganic nonmetallic, organic, and composite materials, as well as test and evaluation, and materials sciences.

Ordnance Corps Claims $16,000,000 VA Savings

(Continued from page 13)

- *A cartridge feed tray which Sprinfield Armory value analyzed for 81 percent savings, cutting its cost from $38.60 to $7.33.*
- *Simplification of a NIKE missile component, by which the Diamond Ordnance Fuze Laboratory reduced the original $65 cost by 65 percent to $23.*
- *Frankford Arsenal's elimination of parts in a fuze assembly to reduce its cost from $9 to $3 for a total savings on* one order *of $81,600.*
- *At the Army Rocket Guided missile Agency, VA completely eliminated the need for two handles on the LaCrosse warhead container to bring the cost down from $24 to a large round zero.*

Acceptance of VA has not always come easily. Proponents of other methods of cost-reduction posed objections to the new system. But, in performance, VA has demonstrated that it both complements and encompasses aspects of time-study, standardization, product and industrial engineering, and similar systems of savings. In fact, the unique feature of VA is its overall quality that bridges the gap between engineering, manufacturing and procurement.

Official recognition of the program has been in ratio to its growth. The progress report made at the end of Watervliet's first year of VA activity excited interest within other Ordnance Corps and Army R&D activities. This resulted in an order to brief major commands and Technical Services chiefs on details of the new cost-cutting method.

In September 1958, the Chief of the Industrial Division, Office of the Chief of Operations, recommended that each commander install a Value Analysis unit, and in April 1959, an Ordnance Corps Technical Instruction directed all installation commanders to implement VA programs.

Value Analysis, now at what may be the threshold of even greater activity, tested and proven as a weapon in the unremitting war against high costs, faces the challenge of the future with confidence born of success.

APG Gives 100 Science Students On-Job Experience

Enriched by practical knowledge in their chosen fields, gained while working as summer employees at the Aberdeen Proving Ground, Md., 100 scientific and engineering students have laid aside their equipment to return to their books.

The "Home of Army Ordnance" established its Summer Employment Program with a 3-fold purpose:

- **To alleviate backlog work through the permance of the summer employees.**
- **To establish and maintain good relationships between the Proving Ground and various colleges and universities.**
- **To create interest on the part of the summer employees in Federal Civil Service careers, preferably with the Department of the Army.**

Among the Proving Ground's summer employees were several graduates of Lehigh University, three of whom were on the Dean's List of honor students. Jerry A. Nolen, Jr., John Buchanan and Denis M. Mulherin, all engineer physics graduates, were employed in the Ballistic Research Laboratories. Jerry is the son of Jerry A. Nolen, Sr., Special Assistant to the Commanding General of Aberdeen Proving Ground.

Holder of a master's degree in psychology from Lehigh, Joseph A. Sgro, of East Haven, Conn., worked as a research psychologist in the Human Engineering Laboratory. He received his A.B. degree in psychology from Trinity College, Hartford, Conn.

Lester A. Edelstein, of University City, Mo., who worked as a research physicist at the Ballistic Research Laboratories, enrolled for the fall term at the University of Maryland for a master's degree. He received his B.S. in physics from Rensselaer Polytechnic Institute in 1960.

Malcolm Taylor, of Bel Air, Md., who worked in the Computing Laboratories, was graduated from the State Teachers College at Towson, Md. He has enrolled at the University of Delaware.

Spending the hot summer days working may not be the nicest way to enjoy a vacation, but the 100 scientific and engineering students chosen to participate in the APG program recognized it as an opportunity to gain practical knowledge invaluable to their career development.

John Buchanan (standing) and Lester Edelstein work with comparator and photometric readout device at APG.

Col Katz Named Deputy CO Of Redstone Arsenal Agency

Col Henry J. Katz, a 25-year Army veteran, has succeeded Col Lester H. LeVine, as Deputy Commander of the U.S. Army Ordnance Missile Support Agency at Redstone Arsenal, Ala.

A 1936 graduate of the U.S. Military Academy at West Point, Col Katz previously served as Commanding Officer of the Ordnance Industrial Center in Europe. The Center did all the centralized Ordnance procurement in Europe and operated four large Ordnance depot maintenance and rebuild plants.

Col Katz holds the Bronze Star medal, the Croix de Guerre, Belgium's Order of Leopold II and the Korean Order of Ulchi for service in Korea with the Eighth U.S. Army.

Shortley after World War II he taught in the mathematics department at West Point. In other assignments, he served at the Erie Ordnance Depot in Ohio, with the Ordnance Tank Automotive Center in Detroit and with the Office of the Chief of Ordnance, Washington, D. C.

SIB Supplies Missile Systems Scattered Throughout World

"For want of a nail the shoe was lost. For want of a shoe the horse was . . ."

Bringing the thesis up to date, the lack of a $10 part could make a multimillion-dollar missile system inoperative.

The mission of 73 people who make up the Secondary Items Branch of the Army Rocket and Guided Missile Agency's Industrial Operations staff is to make sure that doesn't happen.

Probably the most active branch in Ordnance Missile Procurement in the Army, the SIB did a $35.5 million business in the last fiscal year, handling approximately 16,000 items.

Single items ranging from 1-cent washers to $19,000 electron tubes are obtained by this branch, usually in less than a week—this despite the fact that it must service eight ARGMA missile systems scattered throughout the world.

Maj John J. Nearly is Chief of the Procurement Division and Robert D. Ivey is Chief of the Secondary Items Branch.

Morgan Smith Receives APG Robert Kent Award

An exceptionally high standard of performance in directing research and development in the field of aircraft vulnerability has earned Morgan G. Smith the Robert H. Kent Award for 1961 at Aberdeen Proving Ground, Md.

Mr. Smith is Chief of the Aircraft Weapons and Vulnerability Branch, and Deputy Chief of the Weapons System Laboratory, Ballistic Research Laboratories at the Proving Ground. He is responsible for three continuing programs: Vulnerability of Aircraft and Missiles; Vulnerability of Atomic Weapons; and Feasibility of Army Aerial Weapon Systems.

Brig Gen John H. Weber, Commanding General of the Proving Ground, presented the award to Mr. Smith, together with a $100 Series E United States Savings Bond. The award winner's name was inscribed on a bronze plaque in the entrance of the Ballistic Research Laboratories.

Morgan Smith receives Robert H. Kent Award from Brig Gen John H. Weber.

An annual award, the Kent plaque is presented to the BRL scientist whose work is worthy of special recognition. It was established in honor of Mr. Kent, who retired in 1956 after 34 years of service at the Proving Ground.

TRECOM Contracts for Study Of Towed Logistics Gliders

Study leading to the design of towed logistics gliders capable of greatly expanding the cargo carrying capacity of Army aircraft has been stimulated by a $94,000 contract awarded by the U.S. Army Transportation Research Command, Fort Eustis, Va.

The contract, awarded to the Ryan Aeronautical Co., San Diego, Calif., calls for the performance of prototype engineering for several glider configurations employing the Paraglider or Flex Wing principle. This concept utilizes a wing of flexible, plastic-coated material attached to a keel and leading edge members so as to form a dart-shaped, kite-like structure. (See June issue, page 9.) Paragliders capable of carrying up to 10,000 pounds or more are envisioned.

AMRC Responsive to Army Need for Advanced Mathematics

Controversy has existed for centuries as to whether mathematics should be categorized as one of the scientific disciplines or as a methodological art. Certainly it is the square root of all science and the universal servant of the space age.

Behind the establishment of the U.S. Army Mathematics Research Center in 1956, however, is a knowledgeable recognition of the critical essentiality of advanced mathematics techniques to a modern army.

Scientists may have wide variance of thinking in their approach to research problems. But a common denominator of their concepts is that the search for knowledge rests upon mathematical techniques.

Since Army research and development programing is concerned with all the major scientific disciplines, the rapidly expanding need for improved mathematics training became increasingly evident in the years following World War II.

In evaluating the Army's current and long-range requirements, the Army Mathematics Steering Committee concluded that establishment of an adequate research facility rated high priority.

When the U.S. Army Mathematics Research Center's new building was dedicated Apr. 22, 1959, with many noted dignitaries participating, it was the climax of some five years of diligent planning and advance work. The Center occupies a 5-story wing of the University of Wisconsin Physics Department building.

Funds for construction of the AMRC facilities were provided by the Wisconsin Research Foundation, a nonprofit alumni organization which promotes research through annual grants, donations of buildings, and supply of new equipment. Operating funds are provided by the Department of the Army, currently at the rate of about $700,000 annually.

The mission of the AMRC, as stated by an Army spokesman, is "to create and maintain a nucleus of highly qualified mathematicians who can be called upon for advice on specific problems beyond the capability of other Army facilities."

Severely functional in design, the $1,200,000 AMRC facility has been branded "the thinking man's building" because of emphasis on privacy for concentrated consideration of mathematical problems and advanced techniques.

AMRC research branches into four main areas, in each of which a general increase of knowledge is necessary to solve current and anticipated future problems in Army R&D laboratories, arsenals and other facilities.

Principal research areas are defined as:

- *Methods and practices of numerical analysis, with special regard to modern high-speed machine computation.*
- *Statistics and probability (particularly pertinent to the Army's recent emphasis on development of effective techniques of long-range technological forecasting).*
- *Analysis and applied mathematics (theories of differential equations and their boundary problems, fluid mechanics, elasticity, plasticity, electrodynamics, wave guides, networks, etc.).*
- *Operations analysis (programing, etc).*

Army Mathematics Research Center.

Staffed, as of Sept. 1, 1961, with 36 full-time and 14 part-time appointees, the AMRC pools the knowledge of distinguished mathematicians from many parts of the world. Their range of specialties covered more than 20 areas of mathematics, including: analysis, 9; differential equations, 8; computer programing, 7; electromagnetic theory, 4; statistics and probability, 3; elasticity, 3.

Other specialists were representative of operations research, electronics, engineering mechanics, network theory, applied mathematics, mathematics genetics, mathematics physics, mathematics physiology, special mathematical functions, wave mechanics, and acoustics.

Under the direction of Dr. Rudolph E. Langer, the AMRC has made encouraging progress during the past five years in expanding its sphere of influence, in attracting many of the world's foremost mathematicians to scientific meetings, and in broadening training opportunities for outstanding young mathematicians.

Gains also are reported in acquainting civilian mathematicians with Army problems, to the end of increasing their capabilities for assisting the Government in the event of a national emergency

World renowned as a mathematician and an expert in boundary value problems, Director Langer has been notably successful in enlisting the cooperation of eminent authorities from Western Europe, Japan, India and other nations.

Among the many internationally famed mathematicians who have served temporarily on the AMRC staff are: Prof. L. M. Milne-Thomson, known for his work in applied mathematics with the Royal Naval College, England; Prof. Zdenek Kopal, University of Manchester, England, an expert in mathematical astronomy and satellite orbits;

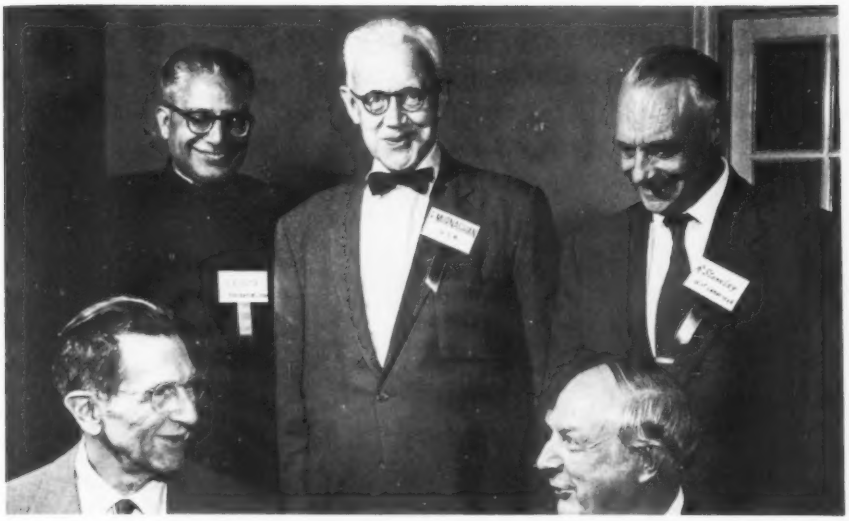
Prof. J. G. van der Corput, an authority on mathematical analysis, Applied Mathematics Center, Holland; Dr. A. S. Householder, an expert in numerical analysis, Oak Ridge National Laboratory, Tenn.; Prof. Cornelius Lanczos, distinguished for his work in applied mathematics with the Institute for Advanced Studies, Dublin, Ireland;

Prof. A .M. Ostrowski, recognized for work in analysis, University of Basel, Switzerland; Prof. Klaus Mueller, acclaimed for his contribution to applied mathematics techniques, University of Aachen, Germany; Prof. Gaetano Fichera, an expert in partial differential equations, University of Rome, Italy;

Prof. Lamberto Cesari, differential equations, University of Michigan; Prof. Arthur Ederlyi, known for his work in special functions of mathematics, California Institute of Technology; Prof. Eberhard Hopf, specialist in fluid dynamics and turbulence, University of Indiana; and Prof. C. C. Lin, applied mathematics, Massachusetts Institute of Technology.

"Europe," commented Dr. Alexander Ostrowski, who has devoted more than 30 years to the complex theory of matrices, "has nothing like the AMRC, where scientists are given complete freedom to think, with no lectures or administrative responsibilities—no interruptions."

In providing this desirable working environment, the AMRC operates with a hard core of permanent personnel to insure adequate continuity of research in specific areas of top priority. A substantial part of the staff, however, consists of mathematicians assigned for limited periods while on



International character of those who attended AMRC conferences is indicated by this group: Dr. Rudolph E. Langer, AMRC Director; Dr. L. M. Milne-Thompson, formerly with the Royal Naval College, England, now with the University of New Mexico; Dr. B. R. Seth, formerly associated with the Indian Institute of Technology, Kharagpur, India, now at AMRC; Dr. F. D. Murnaghan, of the U.S. Navy's David Taylor Model Basin, Carderock, Md., and Dr. Robert Stoneley, of the University of Cambridge, England.

leave of absence from other institutions.

Dr. I. R. Hershner, Jr., Chairman of the Army Mathematics Steering Committee and Chief of the Physical Sciences Division, Army Research Office, Office of the Chief of Research and Development, commented on the AMRC staff Organization:

"One of the purposes of the rotating staff is to keep the scientific interests of the Center fluid and responsive to changing trends. Part-time appointees, in addition to their contributions to the AMRC during their tenure, may be expected to improve the mathematics potential of their home countries upon their return, and to be cordially inclined to the Army's interests."

Services of the AMRC, since it is separately funded, are provided without cost to any Army activity upon request. Liaison visits by staff members of Army activities to the AMRC to discuss mathematics problems are encouraged. Upon request, the Center will consider sending members of its staff to any Army activity for consultation.

When the AMRC sponsors a major conference, representatives of the Technical Services, other Army R&D activities, Department of Defense agencies, and firms or institutions doing contract work for the Army are invited to participate. Proceedings of symposia are published and available upon request from certified agencies or activities.

Conferences have been held as follows: "On Numerical Approximation," Apr. 21-23, 1958; "Boundary Problems in Differential Equations," Apr. 20-22, 1959; "Frontiers of Numerical Mathematics," sponsored jointly with the National Bureau of Standards, Oct. 30-31, 1959; "International Conference on Partial Differential Equations and Continuum Mechanics," June 7-15, 1960; "Electromagnetic Waves," Apr. 10-12, 1961.

In addition to dissemination of conference proceedings, the AMRC has broadened understanding of the wide scope of its investigations through the publication of more than 250 technical summary reports. One of the latest of these is "Circulant Matrices and Some Generalizations," by J. L. Brenner. Reports are provided on request from agencies having a recognized interest.

Overall program guidance to the AMRC is a function of the Army Mathematics Steering Committee, which convenes at least twice a year to review the state-of-the-art and to make pertinent recommendations.

The committee is composed of representatives of the Chief of Research and Development, The Adjutant General, Deputy Chief of Staff for Military Operations, Assistant Chief of Staff for Intelligence, each of the seven Technical Services, the Human Resources Research Office of George Washington University, and the newly established Research Analysis Corporation (successor to the Operations Research Office).

Basic to all AMRC research is potential application of results to Army problems, either immediate or long-range. Men with established reputations for mathematical brilliance are given complete freedom to think. But thinking is consciously and primarily oriented toward military requirements. Regarding this objective the AMRC has published a brochure which states:

"For the Army the advancement of mathematical theory in the fields that have manifest relations with engineering is clearly desirable. New results to be obtained in these fields give high promise of usefulness. To cultivate these fields to the exclusion of others would, however, be to wager against the future. It would be like subscribing to the belief that human ingenuity has found the ultimate. . . .

"Instances of the past are many in which mathematical doctrines that were conceived and developed only as theoretical structures, with no prospects of applicability except to further theory, were suddenly projected into extremely practical roles. Indeed such a projection may well earmark an advance that is phenomenal, not merely a forward step.

"Only recently, number theory and symbolic logic were among the purest of mathematical disciplines. Yet they turned out to be crucial for the extraordinarily practical departures of numerical calculation and data-processing for which the electronic computer is accountable.

"The Army recognizes these facts and therefore spreads its mathematical interests widely. Of course it proportions its support in large measure to the promise that a project holds. However, it regards investigations in all mathematical fields as within the bounds of its concern."

Summing up the importance the Army attaches to operations of the Mathematics Research Center is the statement that:

"The rounding out of existing theories and the creation of new ones, and the progressive discovery and perfection of mathematical methods, are among the most important desiderata for the future. Their promotion is vital, if the Country's technology is not to be allowed to lapse from a leading position."

Dr. Tierney Appointed Chief Of ARO Mathematics Branch

Dr. John A. Tierney has been named Chief of the Mathematics Branch, Physical Sciences Division, Army Research Office.

Formerly an associate professor of mathematics at the U.S. Naval Academy, Annapolis, Md., for 15 years, Dr. Tierney has taught mathematics at Vanderbilt University, Nashville, Tenn., and Norwich University, Northfield, Vt.

Dr. Tierney received a B.E. degree in mathematics from Central Connecticut State College in 1939 and a master's degree in mathematics in 1942 from Columbia University, New York City. He earned a Ph. D. in analysis and applied mathematics from the University of Maryland.

Dr. Tierney is a member of the American Mathematics Society, the Mathematics Association of America, and the National Council of Teachers of Mathematics.

QMFCI Studying Load System Aerial Delivery Problem

By Matthew A. Venetos, Chief, Research and Methods Analysis Branch
Container Division, QM Food and Container Institute for the Armed Forces

Supply and resupply by air will play an increasingly vital role in logistics. The general concept of supply by aerial delivery containers has been employed for some years, and even supply by missile is not entirely new, having been tried out, as a desperate expedient, during the Battle of the Bulge.

Investigations being conducted at the Quartermaster Food and Container Institute for the Armed Forces, one of the laboratories of the U.S. Army QM Research and Engineering Command, are directed toward a highly important phase of aerial supply research—namely, the design and evaluation of load systems to be used with M-4A aerial delivery containers carried by high-speed tactical aircraft.

IMPACT FORCE AND VELOCITY. Solutions to problems of impact damage to air-delivered supplies require experimental data in order to determine the significance of such factors as (a) item "fragility," (b) the orientation of the units in a given load, and (c) the type and positioning of cushioning materials needed to protect shock-sensitive items such as high explosive ammunition, medical instruments, radio sets, etc.

Interrelationships of these and other factors on specific load systems are checked out by QMFCIAF engineers by means of simulated airdrops in the Institute's dropshaft facility. In the shaft, drops from a height up to 60 feet can be made upon a concrete floor impact surface. The data from free fall tests of M-4A loads are measured by electronic instruments.

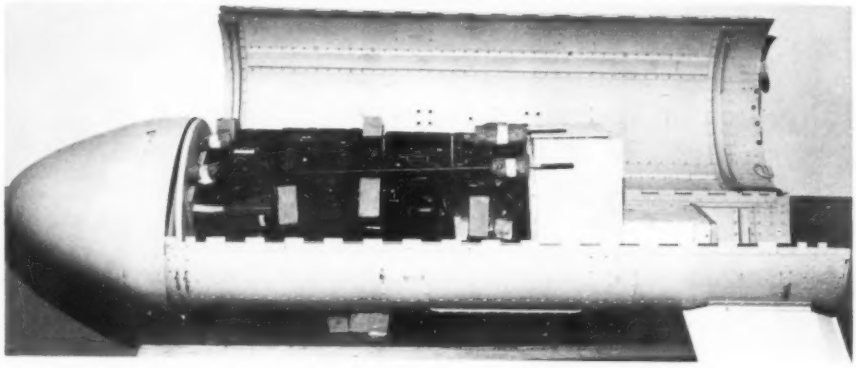
When the results have been accumulated they are utilized in the design of load systems. The systems vary, naturally, with the types of load. Several systems are now ready for the acid test of actual airdrops.

Instrumentation to measure impact velocity is based on a time interval meter correlated with two photocells and light sources. When the falling M-4A container cuts the first light beam it starts the meter, and stops it when it cuts the second light beam. The meter records the time required to travel the distance between the beams and impact velocity is obtaind therefrom by calculation.

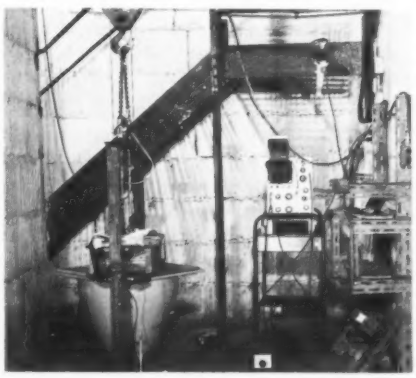
With regard to the determination of impact forces, use is made of an "accelerometer" which measures the deceleration values acting on the load at impact. By the use of Newton's Second Law of Motion these deceleration values are readily converted into the corresponding impact forces acting throughout the load.

GENERAL FINDINGS. What has been learned to date with regard to the prevention of impact damage? Some general design principles which have evolved from this study are as follows:

The orientation of an item with respect to the direction of the impact force can effect significantly the impact resistance of a system. One example of this occurred in the drop test of medical kits. Breakage to clinical thermometers (very fragile items) was eliminated by orienting the thermometers in the kits so that their longitudinal axes were perpendicular to the impact force.



M-4A loaded with radio set (AN/GRC-3) units shows proper positioning and cushioning of set to protect it against impact shock on landing from airdrops.



Drops from heights as high as 60 feet upon a concrete floor impact surface are made in this dropshaft facility.

Another example was the cylindrical tin cans used in the ration packs. The cans have approximately 10 times as much resistance to impact forces applied along their longitudinal axes as to impact forces applied perpendicular to their side walls.

Load distribution between items was also found to be an important factor in damage prevention. In many load systems plywood load spreaders were used between the components to obtain better load distribution. If the layers of a load were unsymmetrical with respect to the longitudinal axis of the M-4A, these layers were alternated to produce a load whose longitudinal axis coincided as closely as possible with that of the M-4A container. This was deemed desirable to assure proper orientation of the container during descent.

An important design consideration is that the center of gravity in a load should not lie aft of the geometric center of the load if tumbling or cartwheeling of the M-4A during descent is to be avoided.

The "shock" rating of an item was found to be the most important factor in designing proper load systems for aerial delivery drops. With a knowledge of an item's shock rating, it is possible to design cushioning systems which will not permit the transfer of impact forces of a greater magnitude than the shock rating of the item being protected. Therefore, without actually testing a load, it can be reasonably assured that a specific load will not be damaged in an airdrop.

SPECIFIC FINDINGS. In the design of load systems problems were encountered which were peculiar to specific load types. For example:

A difficult problem in protecting the AN/GRC-3 radio set against damage was how to cushion it against the shock produced when the M-4A container topples over after impact. The distance between the radio set and the side walls of the M-4A container provided for only a very small stopping distance. Consequently very high impact forces could be expected with conventional energy absorvers.

To reduce the impact forces to the lowest level possible, it was necessary to experiment with various types and shapes of cushioning pads. The intent was to develop a cushion pad of foam type plastic which would exhibit, to a large degree, the force-deflection characteristics of an ideal type cushioning material.

Briefly, an ideal type cushioning material is one which crushes at constant force throughout its range of deformation. This characteristic of the material makes it a more efficient energy absorber than other types of cushioning. The commonly available ideal type energy absorbers were undesirable for one reason or another in this specific application. By experimenting with various geometrically shaped pads of plastic types cushioning materials, a satisfactory pad was obtained.

In load designs where excessive cargo space was being wasted it was found, in many instances, that the exterior packaging could be removed from supply items, thereby increasing the payload without sacrificing impact aims.

Dugway Bids for EM as Civil Service Technicians

Good results are reported for a method of attracting scientific and technical personnel to Government service initiated by the U.S. Chemical Corps at Dugway Proving Ground, Utah.

Enlisted men serving in the area are being briefed on the advantages and opportunities offered by Government service upon completion of their tours of duty with the Army.

Speakers representing the military, the Civil Service Commission, civilian scientists in the Chemical Corps and the Civilian Personnel Office at Dugway are stressing the critical need for young people with formal technical training to enter Government service.

Eighty soldier technicians attended the first briefing, at which the theme was summarized by Clark Stohl, Salt Lake City Field Office Representative, 10th Civil Service Region. Mr. Stohl quoted the Dean of the Graduate School of Public Administration at Harvard University as follows:

"Unless a large number of educated, conscientious and dedicated men, born since 1930 soon decide, despite known or supposed dangers and disadvantages, to devote their lives to the public service, they will find those lives impaired, and perhaps destroyed, by the decisions of others, less well equipped than they, who have seized the places of power that should . . . and could . . . be theirs."

Chemical Corps officials said 51 of the 80 technicians showed a high interest in Government work. Twenty-five indicated a desire to work at Dugway as civilians.

Charles T. James, Civilian Personnel Office at Dugway, asserted that the program "has paid off for Dugway by providing a reserve of 25 potential employees for hard-to-fill positions, and may well prove valuable to other Army activities and Government programs."

ARO-D Arranging for International Symposium

An international symposium on Reversible Photochemical Processes, organized by the Chemistry Division of the Army Research Office-Durham, will be held in late March or April 1962 on the campus of Duke University, Durham, N.C.

Attendance will be limited to approximately 125 scientists of the Free World active in the subject area. Included among those invited are scientists in the United Kingdom, Switzerland, Sweden, West Germany, Holland, Belgium, Israel and Australia.

Serving as an Advisory Committee for the Symposium are Professors H. Byring, University of Utah; L. J. Heidt, Massachusetts Institute of Technology; Gerald Oster, Brooklyn Polytechnic Institute; Melvin Calvin, University of California; George Wald, Harvard University; and J. H. Gould, National Bureau of Standards.

Dr. George M. Wyman, Director, Chemistry Division, ARO-D, is in charge of arrangements.

27 Army Officers Add Meaning To Air Passage During Flight

Air passage has taken on a new meaning.

Recently, 27 Regular Army officers made a 3-hour flight from Aberdeen, Md., where they had attended the Ordnance School, to Redstone Arsenal, Ala., for a special indoctrination course at the Army Ordnance Guided Missile School.

Enroute, some 10,000 feet above the Appalachian Mountains, they took a 2-hour written examination on what they had learned about the Army's latest weapons.

They all passed.

Lt Col Frank B. Greer

Ordnance Officer Receives Award For Building Depot in Cambodia

Lt Col Frank B. Greer, special assistant to the Commanding Officer of Picatinny Arsenal, Dover, N.J., under whose guidance "the first modern Ordnance depot in Cambodia was established," has been citel for meritorious service.

Col R. R. Klanderman, Commanding Officer at the Arsenal, presented the certificate and added his praise for Col Greer's achievements during his recent 2-year tour of duty with the U.S. Military Assistance Group.

Col Greer is a veteran of nearly 20 years' service in the Army. He served in the Africa, Sicily and Italy theaters during World War II, and France and Germany after the war.

By Dr. Ralph G. H. Siu
Technical Director, R&E, OQMG

LESSONS OF HISTORY. Charles A. Beard, the noted historian, was once asked whether or not he could summarize all of the lessons of history in a short book. He replied that he could do it in for sentences:

- Whom the Gods would destroy, they first make mad with power.
- The mills of the Gods grind slowly, but they grind exceedingly fine.
- The bee fertilizes the flower it robs.
- When it is dark enough, you can see the stars.

* * *

THE WAY OF REASON. Pascal noted in his *Pensèes:*

"M. de Roannez said: 'Reasons come to me afterwards, but at first a thing pleases or shocks me without my knowing the reason, and yet it shocks me for that reason, which I only discover afterwards.'

"But I believe not that it shocked him for the reasons which were found afterwards, but that these reasons were only found because it shocked him."

* * *

ADVICE TO AIDES. You may be interested in the following bit of Persian advice given in *The Gulistan of Sadi* (1184-1292) to aides and staff assistants, on how to get ahead. I don't know how many people take Sadi seriously nowadays.

The viziers of Nushirvan happened to discuss an important affair of State, each giving his opinion, according to his knowledge. The King likewise gave his opinion, and Barzachumihr concurred with it. Afterwards the viziers secretly asked him: "What superiority hast thou discovered in the opinion of the King above so many other reflections of wise men?"

The philosopher replied: "Since the termination of the affair is unknown, and it depends upon the will of God whether the opinion of the others will turn out right or wrong, it was better to agree with the opinion of the King, so that, if it should turn out to have been wrong, we may, on account of having followed it, remain free from blame. To proffer an opinion contrary to the King's means to wash the hands in one's own blood; should he in plain day say it is night, it is meet to shout: 'Lo! The moon and the Pleiades'!"

Outstanding employees at White Sands Missile Range, N. Mex., who have been named to take a year's advanced university training at Government expense are shown with Col Paul W. Albert, Commanding Officer, U.S. Army Signal Missile Support Agency at WSMR. Left to right are P. J. Short, William S. Agee, Gerald Mohnkern and Louis D. Duncan. Agee, who has a B.S. degree in physics, will attend Purdue University. Short and Duncan, both mathematicians with M.S. degrees, and Mohnkern, who has a B.S. degree in physics, will study at New Mexico State University.

Vicksburg Station, Redstone Arsenal Organize JETS

Army personnel at the U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss., and at Redstone Arsenal, Huntsville, Ala., are looking forward to the growth of Junior Engineering Technical Society (JETS) organizations after participating in organizing JETS programs.

JETS, a national organization, is a cooperative program by which industry, engineering and scientific societies and educational institutions work together to encourage and assist technical and scientific programs in high schools.

In Mississippi, a JETS program was established during the 1960-61 school year in each of the five high schools in Warren County, where the Army's Waterways Experiment Station is located. This was done through the efforts of an advisory board whose chairman was F. B. Campbell, Chief of the Hydraulic Analysis Branch of the Station.

Five Station engineers served as engineer advisors: Z. B. Fry, Flexible Pavement Branch, Soils Division; Tasso Schmidgall, Hydrodynamics Branch, Hydraulics Division; L. J. Hess and G. R. Cole, Army Mobility Research Center, Soils Division; and C. W. Denzel, Hydraulics Analysis Branch, Hydraulics Division.

Maj Gen John A. Barclay, recently retired as Deputy Commanding General of the Army Ordnance Missile Command and a national director of JETS, and Edwin M. Bartee of the Huntsville Center, have attended organizational meetings of JETS at the Redstone Arsenal.

The Universities of Alabama and Auburn have both been designated as headquarters for JETS in Alabama.

Primary purpose of JETS is the exploration of science and engineering. The clubs elect their own officers to conduct regularly scheduled meetings. Guidance is provided by a teacher adviser, selected from the faculty of the sponsoring school, and an engineer adviser.

At a typical meeting a student or group of students may explain material contained in the "JETS Academic Unit." This is furnished each club by the JETS National Headquarters at Michigan State University. Such topics as testing and test equipment, instrumentation and control, high temperature materials and processes, careers and scholarships, forming of materials, and others are discussed.

Army Recruiting Women in College as Therapists

The Army has initiated a program to encourage young women to become occupational therapists in the Army Medical Specialist Corps.

Courses will be offered to qualified juniors or seniors enrolled as full-time students in accredited college or university programs which include a course in occupational therapy.

Applicants must be unmarried and between the ages of 18 and 28. Those selected will be enlisted in the Women's Army Corps, Army Reserve, with pay and allowances of more than $200 a month. After graduation they will be commissioned as second lieutenants in the AMSC. Prior to certification as occupational therapists they will attend a 36-week Army Clinical Affiliation conducted at selected Army hospitals.

Seniors and juniors who enroll must agree to serve on active duty for periods of two and three years, respectively, after the clinical affiliation course has been satisfactorily completed.

Applications and complete information are available from the Army Medical Specialist Corps Procurement Counselor in each of the Army areas, or from the Office of the Army Surgeon General, ATTN: MEDPT-MP, Washington 25, D.C.

USASRDL Reports Testing of FM Radio Remote Control

Remote control of a new family of tactical FM radio sets is announced by the U.S. Army Signal Research and Development Laboratory, Fort Monmouth, N.J.

The new equipment is undergoing service tests by the Airborne and Electronics Board of the U.S. Continental Army Command at Fort Bragg, N.C The AN/GRA-39 group consists of a control at the radio site and a control at the remote site, connected by a field wire to permit relays through any tactical switchboard.

The remote control unit is equipped with a built-in audio amplifier and loudspeaker. In addition to remote operation of the radio set, the control group provides duplex telephone communication and 2-way signaling between the radio site and the remote location.

Capable of operating the new AN/VRC-12 family of FM radio sets from a position up to three kilometers from the radio site, the control unit is transistorized and operates off regular flashlight batteries. Both units are 8¾ inches high, 8¾ inches deep, and 4 inches wide and weigh approximately 10 pounds each with batteries.

The remote control was developed concurrently with the new family of FM radio sets under a contract with the Stromberg-Carlson Co.

Watervliet Opens New Laboratory To Expand In-House Capability

Watervliet Arsenal at Watervliet, N.Y., recently opened a new mechanical laboratory as part of a long-range program to establish complete in-house research capabilities essential to its weapons development mission.

Dr. Robert E. Weigle, Chief of the Research Branch, said the facility provides sophisticated equipment for analysis of weapons component materials, including tensile strength, fatigue and other properties. Actual firing temperature conditions for gun metals can be simulated up to 1,500 degrees.

Col Maurer Heads Pathology Unit at Fort Knox AMRL

Col Fred D. Maurer, internationally recognized as an authority on viral diseases of domestic animals of economic importance in Africa and the Near East, has been named Director, Pathology Division, at the U.S. Army Medical Research Laboratory, Fort Knox, Ky.

As Director of the AMRL Pathology Division, he will be responsible for the animal pathology aspects of many research programs.

Previously Chief, Veterinary Pathology Division, the Armed Forces Institute of Pathology, Washington, D.C., his duties included direction of six research projects, including the pathological evaluation of irradiated food, malignant lymphoma of domestic animals and cosmic ray studies.

Col Maurer has written a number of articles pointing out the danger of possible importation to the United States of diseases for which there is no known cure, such as rinderpest, infectious bovine rhinotracheitis, bovine pleuropneumonia, African swine fever, hog cholera, and Rift Valley fever.

A native of Idaho, Col Maurer received his doctor of veterinary medicine degree at Washington State College and his Ph. D. degree at Cornell University. Active in many professional organizations in the fields of pathology and veterinary medicine, he is on the Council of the American College of Veterinary Pathologists.

ERDL Recognizes Employees In 33 Promotions, Awards

Lowell H. Barnett, formerly Chief of the Industrial Engineering Branch, U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., has been promoted to Assistant Chief of the Engineering Department.

Presentation of certificates marking the grade promotions of 13 employees at the Laboratories and of various awards to 20 other employees took place recently at Fort Belvoir.

"Outstanding" performance rating and "Sustained Superior Performance" awards were presented, along with cash, to Mrs. Imogene King, $150; Mrs. Yvonne A. McCray, $100; and Mrs. Carol A. Denty, $100. "Sustained Superior Performance" awards went to Charles Dean, $200; Louis J. Long, George Sams, and Edward O. Quinones, $250 each; Ferdinand M. Berry, Mrs. Shirley Harris, and Mrs. Marie S. Fravel, $150 each; and Mrs. Laura J. Tull, $100.

Letters of patent and cash awards of $50 each were presented to T. B Edwards and James E. Malcom, coinventors of a mechanical foam generator. John F. Christian also received letters of patent for an improvement to an eye wash fountain.

Awards for beneficial suggestions went to Willie J. Daniels, Mrs. Irene M. Gilroy, Jerry E. Burgdofer, Mrs. Margaret T. Arnesen, Mrs. Elda A. Boggs, and Chandler Stewart.

2 Major Generals Put In 69 Years

Two Army general officers retired at the end of August after a combined total of more than 69 years of duty.

Maj Gen Charles G. Calloway, Director of Operations, Office, The Quartermaster General, Washington, D.C. retired after more than 32 years of active duty; Maj Gen Richard G. Prather, Headquarters, Sixth U.S. Army, Presidio of San Francisco, Calif., served 37 years.

Artist's concept of plenum air tread (PAT) vehicle under preliminary investigation and development for Army Transportation Research Command.

Versatile Vehicle Would Ride Continuous Air-Filled Track

Preliminary investigation of a new concept in transportation—a vehicle that would operate on a continuous track of rubber-impregnated cells filled with low pressure air, permitting it to travel over soft terrain or water—was initiated recently by award of a $20,000 Army contract.

The projected vehicle is called PAT, for Plenum Air Track. Plenum is an air supply chamber which can be provided with air automatically if pressure is lost. The cells would be self-sealing if punctured. In addition, the machine, which will probably resemble a tank, would have self-cleaning tracks, with air blowing away mud, dust, or snow

Plans call for PAT to travel about 10 miles an hour on water and 50 miles an hour on highways.

Under the first phase of research, Chance Vought Corp. of Dallas, Tex., will design and construct for the U.S. Army Transportation Research Command at Fort Eustis, Va., a half-scale test bed of PAT.

Reservist Stacks Up Honors In 19 Years With Engineers

Oscar P. Cleaver, Chief of the Electrical Department of the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., recently was promoted from lieutenant colonel to colonel in Mobilization Designation Detachment 39.

The first member of the Laboratories' Corps of Engineers Reserve Unit to be promoted to full colonelcy since it was formed in 1950, Mr. Cleaver is also the holder of more work performance awards than any other employee of the Laboratories. He has received 11 "Outstanding" and "Sustained Superior Performance" ratings.

Mr. Cleaver, who has been with the Laboratories in a military and civilian capacity since August 1942, received the Commendation Medal for his services from 1942 to 1946. In 1957 he became the first Department of the Army employee to be chosen to attend the Executive Development Program at Cornell University.

The 56-year-old department chief was awarded a master's degree in electrical engineering by Yale University in 1930. He received his bachelor's degree from Georgia Institute of Technology, where he was high man in his class for four years.

4 Firms Share $20,272,201 For Explosives, Propellants

Four contracts totaling $20,272,201 for the production of ammunition and various components for conventional ammunition, propellants and explosives, and missile warheads, were awarded recently by the Department of the Army.

A contract for $6,433,884, was awarded the Hercules Powder Co., Wilmington, Del., for production of propellants and explosives at Radford Arsenal, Va. About 100 additional workers will be required.

The Harvey Aluminum Sales, Inc., Torrance, Calif., received a $6,141,671 contract for production of classified ammunition items to be produced at Milan Arsenal, Tenn. Approximately 150 additional persons will be employed.

A $5,086,304 contract was awarded to Mason and Hanger-Silas Mason Co., Inc., New York, N.Y., for production of 105 mm. and 90 mm. cartridges, and warheads for the HAWK and NIKE HERCULES missiles at the Burlington, Iowa, Ordnance Plant.

An award of $2,610,342 to Day and Zimmerman, Philadelphia, is for production of components of fuzes, detonators and primers for conventional items and medium caliber ammunition. The work will be performed at the Lone Star Ordnance Plant, Texarkana, Tex.

The Ordnance Ammunition Command, Joliet, Ill., will administer the contracts.

ERDL Human Factors Chief States Views at Conferences

John F. Christian is acting chief of the newly organized Human Factors Branch at the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va.

Attendees at the Seventh Annual Army Human Factors Engineering Conference this month at Ann Arbor, Mich., heard him present a paper titled "A Human Factors Review of the Crew Compartment of the Armored Vehicle Launched Bridge."

During the summer Mr. Christian presented a paper, "Ergonomics—Palliative or Definitive," at the First International Congress on Ergonomics at Stockholm, Sweden.

Mr. Christian's paper was a plea for a more comprehensive type of human factors engineering. He contended that human factors engineering is not being applied as effectively as it could be to products because the human factors engineer lacks a background in engineering, economics and esthetics.

Ergonomics is a word coined in England to cover the "anatomical, physiological and psychological study of man in his working environment," thus human factors engineering.

Inventors Council Supports DOD in Encouraging Independent Creativeness

In view of the increasing trend toward team research, coupled with the soaring costs of modern laboratory and technical equipment, the question arises: Can independent inventors working alone contribute anything of value to the national defense effort?

Military planners think so, and believe that what are presently fuzzy concepts in the minds of imaginative men could produce many of the inventions this Nation may depend on for future security.

They recall ruefully that it was an American scientist working alone, Robert H. Goddard, who developed much of the rocket technology used by the Germans to build the V-Is and V-IIs, though his work went almost unnoticed in this country.

The National Inventors Council of the Department of Commerce has the job of insuring that the genius of men such as Goddard is placed at the disposal of the Department of Defense.

Though billions of dollars are spent annually to have large companies and military, industry, and university laboratories join in research and development to improve or innovate military essentials for national security, the Department of Defense is increasingly alert to possibilities of valuable work done by independent inventors.

In stimulating and encouraging the independent, DOD leaders are mindful that during the past 50 years individuals, working without organizational support, were either entirely responsible for or played a major role in: evolution of jet engines, gyro-compasses, helicopters, rockets, automatic guns, suspension tanks, noiseless and flashless machineguns, the cryotron, the Sidewinder missile, and many other valuable military products.

Basic functions of the Inventors Council are to let the independent inventor know what the Department of Defense needs, and to let the Department of Defense know what the inventor has come up with that may be of use.

The first function is fulfilled by sending to known inventors a pamphlet listing "Inventions Wanted by the Armed Forces," which is updated periodically. An Army R&D researcher confronted by a particularly baffling problem can get other inventors throughout the country working on it for him by describing what he needs in the pamphlet.

The second function is fulfilled by processing and evaluating ideas sent to the Council and sending pertinent ones to the appropriate military organization.

Initiated by the Army in 1960 was an 8-volume Problems Guide *(currently being updated) listing all the R&D areas in which the Department of the Army is seeking help wherever help can be found. Volume 8, unclassified and available therefore to anyone interested, listed 330 problems in the physical, life, environmental, psychological, and social sciences—a fertile field for independents looking for R&D ideas.*

A valuable source of inventive ideas comprises technically trained innovators already working for the defense establishment. A recent report prepared for the Council and the three services by Arthur D. Little, Inc., points out there are many "innovative technical personnel in military laboratories who may make technical contributions as individuals outside of their assigned work."

Government researchers have a head start when they exercise their inventive spirit on their own time, according to the Little Report, because "they know what the technical problems are. . . . They have access to prior art in these fields. . . . They are subject to minimum security restrictions. . . . They are already organized as a resource, unlike individuals in other settings."

For their efforts, civilian government personnel can get up to $25,000 under the Government Employees' Incentive Awards Program, and can also receive other awards for the use of their inventions.

Dr. William B. McClean of the Navy received $25,000 for his development of the Sidewinder missile. Recently three scientists from the Army's Picatinny Arsenal in New Jersey split $25,000 for their development of nuclear weapons, including a warhead for the portable DAVY CROCKETT missile. (See "Army R&D Newsmagazine," June, page 1.)

Inventive civilian Government employees enjoy an exclusive privilege. The Commissioner of Patents may grant them a patent without payment of fees if the head of a department or agency certifies the invention is used or likely to be used in the public interest. The applicant must state that his invention may be used by or for the Government without payment of royalty.

Each month the Council receives approximately 1,000 letters from aspiring inventors. About 100 are from persons with scientific, technical backgrounds whose proposals are directed to the solution of valid national defense problems. The Council staff rejects about 70 because the idea is not new, or not superior to an alternative method. Sent to the appropriate military agency for investigation, about 20 of the remaining 30 proposals are rejected as unsuitable.

Consequently about 120 inventions are placed with the military establishment each year that have some value and deserve laboratory investigation. How many of these are finally accepted in one form or another is not known by the Council, because at this point the military agency deals directly with the inventor and the Council steps out of the picture.

Established in 1940 the Council, by insuring inventors that their inventions will be evaluated and sent to the proper agency, has become a valuable source of new ideas for military research.

The Council employs a full-time staff at the Department of Commerce which does the actual job of screening and analyzing the inventors' ideas. The Staff is comprised of engineers, chemists, physicists, and other technically trained personnel who are aware, through continuous study, of the changing needs of the military establishment.

The Council protects inventors who do not or cannot patent their ideas by holding all material submitted in strict confidence and by taking all possible steps to safeguard an inventor's rights. Each proposal is automatically stamped with the date and hour received by the Council—evidence always available in any subsequent controversy over priority of inventorship.

The Council does not send back to the would-be inventor his proposal even if it is rejected. Past experience has taught the Council's staff that an idea rejected today may be useful tomorrow.

During World War II, a plan for an electrical firing device was at first rejected because there seemed to be no use for it. Several months later, when an electrical initiator was needed for the bazooka rocket launcher, the firing device was taken from Council files and put into production

Under consideration is a proposal to expand the Council's duties from those of a middleman between individual inventors and the military to that of a pilot research and development organization financing the making of first-stage models of promising ideas.

The Little Report contends that the great resource of individual inventors available to the military establishment is not being fully utilized, and that the foregoing proposal would do much to secure many more useful ideas for military appraisal.

The Report also recommends passage of legislation that would permit the Government to provide more numerous and more liberal cash awards for inventions submitted to the screening offices and used by the military.

The Report states that greater incentives must be given to the private inventor in order to allow the Government the full use of his knowledge—possibly vital to future national security.

Present Chairman of the Council is Dr. Charles Stark Draper, Director of the Department of Aeonautics and Astronautics, Instrumentation Laboratory, Massachusetts Institute of Technology. Secretary is Homer H. Ewing.

Members of the Council representing the military services are Maj Gen W. J. Ely, Director of Army Research, Office of Chief of Research and Development; Rear Adm L. D. Coates, Chief of Naval Research; and Brig Gen Ralph L. Wassell, Director of Research and Development, Deputy Chief of Staff for Development, U.S. Air Force.

AOMC Tests Impact Of Missiles on Tanks

One of the few men who knows for sure just how it feels to be in a vehicle when it is smacked by a missile says it "is like running into a brick wall blindfolded."

Ross Williams is the foreman for a group of 15 Army Ordnance Missile Command engineers who do their testing at the receiving end. Safely tucked behind the armor plate of Army tanks, they ply their trade as clay pigeons in a missile shooting gallery at Redstone Arsenal, Ala.

Missiles fired at the tanks are not armed with their high explosive warheads, but they come down range like lions looking for something to bite.

"Watching a missile come at you can be disquieting," says Williams, a man not given to overstatement.

"Once my navigator, who was supposed to be telling me where to steer the tank, got so fascinated with the sight of a missile bearing down on him that he forgot to give me directions. I drove the tank into a ditch."

Williams and the other men who pilot the target tanks work in the Test and Evaluation Laboratory of the Army Rocket and Guided Missile Agency, AOMC. Their job, like that of thousands of other Army military and civilian experts at Redstone, consists of developing, testing and evaluating Army missiles.

In the case of antitank missiles, the Army wants to know how well they perform against moving targets. The Army has found that live drivers operate the mobile targets in a more realistic manner. They also eliminate the need for a costly and not so effective remote control steering system for the tanks.

James L. Cooper gives the okay sign to Alvin Reid to close the tank hatch. Both men drive old tanks used as mobile targets for test firings of missiles.

Most of the tanks are World War II types rescued from the scrap heap. They are equipped with periscopes so that the driver can be safely "buttoned up" inside. In the pre-periscope days, a man sat in the tank turret to peer through viewing slits and guide the driver seated below him by tapping him on the shoulder to indicate a change in direction.

"Now that we've got periscopes you never know when the missile is going to hit you," Williams said. "The navigator used to keep us posted, but now the driver is the only man in the tank and he has to keep his eyes on where he's going."

During a missile test, the tank driver receives the prefiring countdown. This insures that he has his vehicle up to speed, traveling in the direction and at the point down range required for the particular test at the time the missile is fired.

"These unarmed missiles never hurt the tank," Williams said. "Oh the force of impact bent a tread once, but that doesn't happen very often.

"Usually the test is over before you have time to think about the missile hitting the tank. I don't mind it at all. But they can look for another tank driver when they start shooting with live warheads."

Army Leaders Meet in Washington To Integrate R&D in Cold Regions

Wide-ranging discussions regarding an integrated cold regions RDT&E program for FY 1963 marked the Fourth Annual Cold Regions R&D Planning Conference held in Washington, D.C., Sept. 28-29.

Reflecting the Army's increased R&D activities in Alaska, the conference was keynoted by Maj Gen William J. Ely, Director of Army Research, OCRD.

Presentations were made by representatives of all Army Technical Services, the U.S. Continental Army Command (USCONARC) and U.S. Army, Alaska (USARAL). These included discussions of planned research and testing programs, personnel and support requirements, and funding estimates.

Comments were made also by representatives of the Director of Defense, Research and Engineering (DDR&E), Deputy Chief of Staff for Operations (DCSOPS), Deputy Chief of Staff for Logistics (DCSLOG), Assistant Chief of Staff for Intelligence (ACSI), Human Resources Research Office (HumRRO), the Navy and the Air Force.

Representatives of all divisions of the Army Research Office, Office of the Chief of Research and Development, and of the Army Scientific Advisory Panel attended the conference.

Dr. L. S. Wilson, Chief of the Earth Sciences Division, Army Research Office, presided.

"Of course, there's still some "bugs"; but we think we're on the verge of a real breakthrough here."

Chemical Corps Research Evolves 'Mr. America' Head as Mask Design Aid

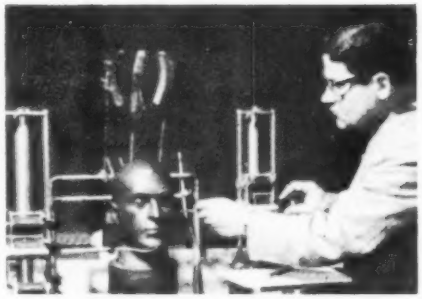
A wedding of art and science has produced "Mr. America"—a bronze head with the size and shape of that of the average American soldier.

Mr. America is one of 10 finely sculptured heads at the U.S. Army Chemical Corps Research and Development Laboratories. Far from being mere ornaments, the heads are valuable tools for the people who design and develop protective masks.

On these 10 headforms, whose contours and dimensions represent the key facial types of the American soldier, are fitted the ever-changing experimental facepieces created during the process of mask refinement and the development of new masks by the Chemical Corps.

The headforms are not artist conceptions of typical faces. They were created after a scientific examination of the heads and faces of 3,107 male members of the Army.

Forty-two caliper measurements were made of each of the 3,107 subjects; 1,470 of the soldiers' faces were charted and "mapped" by using a specially designed instrument called a "faceometer"; 128 plaster life-size masks were made.



Measurements of headform at the Chemical Corps R&D Laboratories are checked out by Eugene Sovinsky, Chief of Product Development Section.

Ten types of heads were selected as key forms. These were created by Boston sculptor George Demetrius and cast in bronze. Five of these are used in basic designs. Among them is the medium headform, constructed according to the mean of all the measurements taken. This is Mr. America —the workhorse of the group.

Others in the basic set are classified as "small," "medium-small," "medium-large" and "large." The remaining five headforms are "unharmonic," representing medium faces with deviations from the norm in length, breadth and depth.

Duplicate sets have traveled widely to serve as precision-made models on loan to the Office of The Surgeon General, the Army Quartermaster Corps, the Air Force and the Massachuetts Institute of Technology.

The headforms also have modeled for many experimental items other than military on a no-cost loan basis to industry. From designs fitted to their features have come civilian protective equipment such as dust respirators, safety glasses, crash helmets, welding helmets and face shields.

CE Buys Spacecraft Kits For Broad Geodetic Study

Delivery of special geodetic spacecraft packages for use in a worldwide geodetic program by the U.S. Army Corps of Engineers is scheduled to begin in November under an Army contract awarded to the Cubic Corp.

Designed for launching by solid-fuel vehicles, the packages will be used as part of the SECOR (Sequential Collation of Range) system, an application of radio ranging techniques to geodesy.

In conjunction with four ground stations, three of them placed at accurately surveyed points, the spacecraft packages are expected to provide improved accuracy and speedier findings in mapping work.

Cooperating in the geodetic program employing the spacecraft packages are the U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, and the Army Map Service

Head-on collision between a 105 mm. target projectile and a .30 caliber cylindrical pellet (right) at a combined velocity of about 20,000 feet per second resulted in quite a nick in the target projectile. Pellets were fired at projectiles in flight by scientists at the Ballistics Research Laboratories, Aberdeen Proving Ground, Md., in a study of the effects of impact at high velocities, which will help decide the size and shape of future interceptor missiles for defense of the Nation.

APG Physicist Presented Gordon Memorial Award

Morton Sultanoff, a research physicist at the Ballistic Research Laboratories, Aberdeen Proving Ground, Md., recently received the Robert Gordon Memorial Award of the Society of Photographic Instrumentation Engineers.

The award, presented at the Society's Sixth Annual Technical Symposium in Los Angeles, was in recognition of "his exceptional contributions to the advancement of photographic instrumentation in the science of observation, recording and measurement."

As Chief, Detonation Section, Mr. Sultanoff has developed and employed unusual and original photographic instrumentation techniques in the study of the basic physical features of explosive reactions. Several years ago he developed a camera capable of recording 100,000,000 pictures a second.

Internationally recognized as a leading expert in the field of ultra-high-speed optical recording, he has been praised for his techniques in scientific journals published in England, India, Japan, the Soviet Union, West Germany, and Israel.